

Your

AN ARGUS SPECIALIST PUBLICATION

November 1985

£1.00

COMMODORE

YOUR BEST INDEPENDENT COMMODORE MAGAZINE

Now Incorporating

YOUR 64

Modch 1 -
the first part of
our type in
assembler



Full colour
Action Replay

Competition -
10 Commodore
models must
be won

Summer Games II -
Game of the month

**Inside
the 128**

WIZARD
COMPUTER GAMES

A NEW EXCITING ADVENTURE GAME By Tony Crowther
£1000 Treasure to be won & a free disk with every game
Available for Commodore 64, Spectrum & MSX (from October 95) (to be available for Amstrad)

WILLIAM WOBBLER



"The game is set in a dark, mysterious world. The player must solve many puzzles, defeat many monsters, and reach the goal. The game is set in a dark, mysterious world. The player must solve many puzzles, defeat many monsters, and reach the goal."

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William Wobbler is the latest game from Tony Crowther—a most exciting adventure game. Through the underworld of dark powers in search of golden treasure William struggles against all odds to vanquish foes and reach his goal. A game of skill and excitement.



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Editor:
Stuart Cooke

Assistant Editor:
Mark Curry

Advertisement Manager:
Mike Segrave

Advertisement Copy Control:
Lynne Champion

Group Editor:
Dave Bradshaw

Group Managing Editor:
Wendy Palmer

Managing Director:
Peter Mathison

Origination:
Gordon Typographical

Design:
Argus Design

Editorial & Advertisement Office
No 1 Golden Square
London W1R 3AB
Telephone: 01-437 0026
Telex: 880188G

Your Commodore is a monthly magazine appearing on the first Friday of each month.

Distribution to Argus Press
Sales & Distribution Ltd, 11-15
Paul Street, London EC2A 4JF
Revised by: Andrew Freeman
& Sons Ltd, York, Maidstone,
Barn

Subscription rates upon
application to Your
Commodore Subscriptions
Department, Informa Ltd, Times
House, 175 The Strand,
London WC2R 0BH. (Telex: 9471
188)

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Our COMMENT

THIS MONTH, WE'RE DELIGHTED TO announce that Your Commodore has now joined forces with Your 64 to bring you the best Commodore magazine around.

Publishers of Your Commodore, Argus Specialist Publications, recently concluded the purchase of Your 64 from Sportsman Press, Peter Welfham, AEP's MD, said: "This acquisition consolidates our position as one of the leading titles in the bipersonal Commodore market and further confirms our commitment to machine specific titles."

We're pleased to welcome all our new readers to our pages and we can promise that you won't be disappointed; we're really going to have our work cut out over the next few months making sure we bring you only the best in software and hardware reviews, games and utility listings, plus many exciting and absorbing features for you to follow.

We're also very conscious of the fact that a magazine is nothing without its readers and so we'll be waiting anxiously for the postman every day to find out what you really think about our magazine.

Write to us at Your Commodore, No 1 Golden Square, London W1R 3AH and let us know what you think are the best (and worst) features of the magazine and give us your ideas on what needs to be included. We promise to read everything you send so get those letters in the post now.

Stay with us over the next few months and we'll bring you the only Commodore magazine worth reading.

Start

DATA STATEMENTS



Part of Arkissoft's new range

The sky's the limit

ARKISADVENT'S RECENT SUCCESS, *SKYFOX*, has now been released on cassette priced at £19.95. The game was originally only available on disk and the cassette version eventually released was the third attempt at maintaining the standard of *Skyfox* since two earlier conversions were rejected by the manufacturers as being not up to scratch.

Skyfox is only one of a number of new releases from Arkissoft. The latest titles are *Racing Destruction Set*, *Pinball Construction Set*, *Adventure Construction Set*, *Music Construction Set*, *Seven Cities of Gold* and *Mail-Order Monsters*. So far these titles are only available on disk and are all priced at £14.95.

Arkissoft can be contacted at Suite 101/105 Asphalte House, Palace St, London SW1E 9HS.

Chatting up

COMPUTER IS DEVELOPING A NEW service scheduled for a late autumn launch. It is a scintillating CB-style chat facility. The chat line will allow users to hold conversations in real time with other users all over the country.

Contributions are typed into a window at the bottom of the screen while a second window above displays messages from other users. By scrolling back and forth the whole conversation can be reviewed. Users with similar interests can form groups by using individual chat lines which will be provided and those wanting a chat can monitor various conversations before deciding which one to join.

For further information contact: Compuser, Merford House, 15-18 Clapham St, London W1P 2DP.



Starstruck

STARBUCK FROM MELBOURNE HOUSE is now available for the Commodore. It was originally released for the Spectrum and Amstrad computers.

The game will be priced at £9.95 and is obtainable from Melbourne House, Castle Yard House, Castle Yard, Richmond TW9 6ET.

Beyond the fringe

BEYOND IS BRANCHING OUT WITH two new games.

The first is the computer version of Superman, a game developed at a joint venture with First Star. Bill Delaney, Beyond's MD said: "It will shoot to number one in every software chart."

Beyond has also formed a partnership with another software house, Nexus. The first game to appear on the new label will be called Nexus and will be a "sophisticated graphic adventure where the player becomes an investigative journalist infiltrating an evil drugs ring in South America."

According to Nexus, the game will offer maximum playability and user friendliness. Instead of having to read pages of documentation before starting, the player will be able to experience action straight away through on screen instructions. Nexus will also feature digitised video images which, it is claimed, will generate realistic animation enabling the player to recognise various characters.

Nexus costs £9.95 and is available from Beyond, Durrant House, 8 Herbal Hall, London EC1R 3EL.



Starbuck from Melbourne House

Gold standards

UK Gold has brought out yet another batch of new releases. The three latest titles are Monster Trivia, Beach Head II and Ghostchaser.

Monster Trivia is a spin off from the enormously successful board game, Trivial Pursuit, but in this version you get killed by a monster if you get enough questions wrong.

Beach Head II is the follow-up to Beach Head and features multi-screen play, complex strategy, animation and high speed arcade action.

Ghostchaser takes Harry around haunted Manor where he must beat large ghosts which materialise at random.

All the new titles are for the C64 on cassette or disk and cost £9.95 and £14.95 respectively. You can get in touch with UK Gold at Unit 18, The Parkway Industrial Centre, Henegate St, Birmingham B7 4LT.

You pop

POP STAR, PEARCE & SHARKEY, HAS recently become the owner of the first production model of Supersoft's digital sampler for the C64.

We visited the Supersoft stand at the Commodore Computer Show and were very impressed with the unusual reproduction quality of the new product.

The sampler is called Microson and offers eight different sampling rates, up to a maximum of 48000 which gives a 100Hz band width. Samples can be played forward or backward and there is full editing and looping with a high resolution display.

A 2000 note sequencer is included as part of the Microson software with real time recording and step time editing.

Microson costs £299.95 and is available through music shops, computer stores or direct from Supersoft at Winchester House, Canning Rd, Wokingham, Wiltshire HA3 7TS. A disc drive is essential.



Pearce & Sharkey sit up and take notice



On Jet!

Jumping the gun

C-18 and Plus II owners can now pick up a bargain in joysticks with Trilux Electronics new packages.

The Gunshot I joystick is now being sold complete with an adaptor for C18/II. The packs are available from Dixons, Laskys and other computer retailers.

Everything the user needs to connect the joystick to his computer is included plus concise instructions and a 12 month guarantee slip.

For more information contact: Trilux Electronics, 200 Broad St, Hendon, London HA5 1BL.

Eye contact

SPECTACLE WEARERS WHO USE YOUR car or television screens as a major part of their everyday lives can now try a new way of protecting themselves from eyestrain.

Balzers has come up with Gazeon, a tough anti-reflection coating which, claim the makers, virtually eliminates lens surface reflections especially those caused by strong projected images. The coating can increase light transmission to almost 100 per cent.

The result for the user is that extra visual sharpness is noticeable during long periods of exposure, thus reducing visual fatigue.

For more information contact: Balzers, Northbridge Rd, Beckenham, Kent BN4 1LN.



"It's never here to feel like this again!"

Become a boffin

A NEW HOME COMPUTER TEACHING course has recently been released by Fearless Software. It is claimed that the course will take you from scratch to complete computer literacy in 12 months.

Peter Ellis, who founded the company to produce and market the Home Tutor said: "It is for children, housewives and the retired. It is also for those seeking new jobs or looking for promotion with their present employer."

The course is available on tape or disk and includes, demonstrations, contacts and tests the students. There is an examination at the end and those who pass receive a certificate.

The course starts by explaining what a computer is and goes on to teach basic and machine code, covering such areas as information storage and communications. There are 12 parts to collect over the 12 month period.

Home Tutor costs £12.50 per month including tapes, teaching notes, a carrying case and ring binder. For disks the cost is £7 extra and postage is £1.15. Quarterly charges are £30 for tapes and £35.50 for disks.

For more information contact: Fearless Software, Integrip, 38 Eastbourne Terrace, London WC1.

Errata

A NUMBER OF PEOPLE SEEM TO BE having problems entering the Sketch Pad program which appeared in the September issue of Your Commodore. There are no errors in the program but some of the codes that our printer interface was used to be causing the problems.

In line 1490 the [255] is actually the character code for p (or n). This character is to be found on the key next to the

RESTORE key. When entering the program you should type in the p and not [255].

Another line that is causing problems is 628. It appears that in some issues of the magazine this has not reproduced very well. Line 628 should start with IF XC = 256 THEN

A number of people also seem to be having problems finding the I character on their keyboard this is the up arrow. I to be found on the key next to the RESTORE key. The printer that we use does not print the downstroke of the arrow.



British Telecom and Program experts sign up

Telecom deal

BRITISH TELECOM AND PROGRAM EXPERTS have joined forces to make the lives of software retailers and buyers less fraught with frustration.

Program Experts is the firm which launched the Electronic Distribution of Software Machine in July 1988 which works on a "Central Computer Network/In-store Satellite Terminal" principle. The retailer can download a unit of software from the in-store terminal onto a blank tape. The machine records all relevant details about the sale and at the same time new titles can be added to the hard disk terminal while old ones are deleted.

Under the new agreement British Telecom will finance the operation and Program Experts's three directors, Gilmore Kennedy, Bruce Nayliffe and Gauri Robertson will run the company autonomously.



The in-store terminal

Agony Aunt Tony Crowther

answers more of your
programming questions.

INPUT

I have been told on many occasions that it is possible to make all of the keys on the C64 keyboard repeat, as on the Spectrum.

This seems to be a very handy facility as you could enter long strings of the same character without having to press the key for each letter.

However, I do have one slight problem, somehow can I find mention of how to do this. Would it be possible to provide me with the necessary commands or program to make the C64's keys repeat?

Mike Alderton
Tunbridge

OUTPUT

Yes, it is possible to make all of the keys on the C64 repeat and it is very easy to do. All you have to do is POKE into a few memory locations. The locations are as follows:

Location	POKE	Result
458	255	all keys repeat
458	0	no keys repeat
458	128	just the various repeat
451	0-255	repeat speed
451	0-255	delay before repeat

The keyboard scan is done by the hardware IRQ interrupt, if we change the clock rate of timer 4, we can make the rate of the interrupts speed up or slow down. Try:

POKE 56125, number (0 to 255)

a number of zero to 99 leaves many interrupts a second and causes the Basic run speed to slow down. This could be used to your advantage when debugging a Basic program as everything will slow down.

INPUT

I write to congratulate you on the quality of your magazine, I find it to be the best of the British Commodore mags available in Australia. However I feel that the atrocious reproduction of graphics symbols spoils it. I would suggest that you employ a system like the American magazine 'Amp', which permits rapid loading and clear understanding of listings.

P Robinson,
Blackwater,
Australia

INPUT

I'm not sure what system Aldon uses but we nevertheless accept that the listings need improving. Therefore we will be using a Micrograph 549030 in future, which replaces all graphic characters with a short description.

INPUT

I have a problem with my 64 that I cannot get an answer to. After about two hours my computer crashes, putting random graphics on the screen and eventually the whole screen is covered in flashing graphics. If I switch it off for a couple of hours the problem goes away but it occurs more frequently afterwards.

L. Ross
South Shields
Tyne & Wear

OUTPUT

The problem is that your 64 is overheating. I suggest that you take it back to the dealer and see if he can replace it.

INPUT

In your March issue you did a feature on Games creators and this article impressed me so much that I wish now to buy one. The one I am interested in is the Quill by Gilbooth, could you please tell me their address.
P. Vassallo
Pinto
Malta

Gilbooth are at:
30 Hawthorn Road,
Bury,
S. Glancs.
CF8 9LZ.

OUTPUT

INPUT

I'm writing a program in machine code that requires a lot of data storage. I understand that there is 64 of RAM underneath the Basic kernel. This would be an ideal place to store my data and machine code routines.

Could you please explain how I access this area of memory so when I try I don't get the Basic ROM and not the numbers I have stored beneath it?

OUTPUT

As you have already found out you can't use the area of memory beneath the Basic kernel where Basic is running as any pointer or calls to that area will just go to the kernel. If however you are using machine code you can turn off the Basic kernel and use the memory that sits beneath it quite easily.

First you must switch off the Basic ROM. To do this you must take the lower bit of memory location 561, this can be done simply by subtracting one from it. If this action was to take place in Basic your program would crash. However, in machine code it will not affect the program.

If your machine code routine was to start at — at your data was stored at — location 5600 (5400), then this small routine would allow you to access it.

```

54000 DMC 101      ; switch off Basic ROM
54001 DMC 54000     ; jump to start of
                    ; program
54002 DMC 561       ; back here from your
                    ; routine

; find turn Basic
                    ; back on
54003 DMC 575       ; return to Basic at end
                    ; of program
  
```

OUTPUT



COMMODORE SOFTWARE THROUGH THE POST.

(WITHOUT PAYING THROUGH THE NOSE.)

Simply send off this page
and you'll get:

SOFT POST MAGAZINE FREE

No more trawling around the shops trying to find the software you want. Let Commodore post it to you. Simply make your selection from our Soft Post magazines which will send you every few months (they're packed full of software information) — but there's no obligation to buy anything, if you don't want to.



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In every magazine there'll be special offers, an enormous selection of great software at amazing prices — and not just games, but educational, business and home use, too. (Sometimes you'll even find peripherals at special prices.)

PLUS ONE OF THESE PROGRAMS FREE

Tick the box against the software of your choice

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<input type="checkbox"/> Know your Own ID (quiz)	<input type="checkbox"/>	<input type="checkbox"/> Omega Race (sport)	<input type="checkbox"/>
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Stuart Cooke has

spent hours slaving

over a red hot

Commodore 128 and

he's decided that it

was definitely worth

the effort.

THE C128 -IN DEPTH

COMMODORE ARE ALL SET to prove that those into one don't go with their new Commodore 128 computer.

The C128 is essentially three computers in one. Inside a case that looks at though it would be quite at home on the flight deck of some futuristic spaceship, there is a good old C64. Secondly we have what can only be described as an upgrade of the C64, 128 mode. Hardcore-wise this is the same as the C64 with only a few changes. Thirdly there is a machine that has also been around for quite a long time, but not from Commodore. This is a CP/M computer. CP/M has been around for a number of years and is the same given to an operating system that is used on over 280 based business systems to allow a great deal of compatibility between manufacturers. Perhaps one of the most famous business packages that runs under CP/M is the word-processing package Wordstar which is in use in thousands of offices around the world.

First Impressions

The first thing that you notice about the C128 is that you are not getting some fantastic new machine for your money. What you do get are two very well established machines and one very good up grade.

The machine itself has been designed to achieve as much compatibility as possible with the C64 and other Commodore products. For this reason many of the expansion connectors will be familiar to owners of other Commodore machines. There are connectors on the machine for two joystick, Commodore's own serial peripheral connector, TV interface,

composite video interface, a standard Commodore cassette interface, a user port and a cartridge port. Now items obvious on the sides of the machine are a reset switch and a RGB monitor interface.

Even though Commodore has tried to make the C128 as compatible as possible with the C64, the cassette interface is in a silly position. If you plug a Commodore modem into the cartridge port the casing of the modem obscures the cassette interface preventing a cassette recorder from being plugged in.

The keyboard bears only a slight resemblance to earlier Commodore machines as there are more keys available. Added keys include a numeric keypad and a large number of function keys.

In Use

When powering up you are able to decide whether you

wish to boot up the C128 in 40 or 80 columns. CP/M, 128 or 64 modes. Here we come across the first problem with the C128. The 80 column display can only be viewed on a monitor that is plugged into the RGB interface while the 40 column display can only be viewed on a TV or monitor plugged into the composite video socket. If you wish to use both 40 and 80 columns then you will need two different monitors. Commodore has produced a new monitor that will allow you to switch between the two modes of operation. A monochrome composite signal is present on the RGB socket so you can plug a monochrome monitor to view 80 columns. If you already own one. Using a monochrome monitor will not cause any problems especially when you realise that the 80 column mode is text only and no graphics are available.

C64 mode offers nothing new, what it does do however

is allow you to use all of the packages that are currently available for the C64 on your C128 computer. This is great news for people who already own C64s and are thinking about upgrading. Over 100 pieces of software were tried on the review machine and all of them worked correctly. The only problem that we found was with programs that used keyboard overlays as the keys are in different positions. This is especially noticeable with Commodore Music Maker packages as the keyboard will not fit the new design. Even so, it appears that all problems will work with no fault.

An on board 280 micro processor allows you to run CP/M Plus version 3.0. CP/M Plus will give your CP/M programs full access to the 128k of RAM that is built into the machine as standard. Commodore has made a few changes to CP/M Plus, mostly by adding some new com-





Instruction, **RECUR/BIND** will allow a number of program lines to be included after a **THEN** statement.

Graphics

Budding artists are well-served for inside Basic 7.0 by a large number of graphic commands. **GRAPHIC** is used to turn on one of the six different graphics

modes. Because of this total CP/M compatibility is something that will have to be proved. Unfortunately the review machine did not come with any CP/M software so this was something that I was unable to test.

As I have already mentioned, 128 mode offers nothing very new apart from an enhanced Basic and an 80 column display. Basic 7.0 can only be described as the Basic that should have been implemented on the C64 as it allows total control of all the facilities offered by the hardware without having to resort to POKEs or machine code.

The new disc drive is also a great improvement on the old 1541 when used in C128 or CP/M mode as it will LOAD and SAVE programs around three to four times faster — a great relief to anyone who has used a 1541. Unfortunately, when used in C64 mode the drive works at the same slow speed that we all know and hate.

Basic 7.0

Basic 7.0 contains a large number of commands that are designed to ease the use of word and graphics together with a large number of 'bookie' commands, for example the **AUTO** command will automatically give line numbers,

RIGHT and **LEFT** allow you to 'lead' and save specific sections of memory. A number function helps with the development of long programs. Programs that do not work correctly are easier to debug with the **HELP** command which will show you where your error has occurred or the **TRON** and **TRONF** commands which will display the line number of the line that is about to be executed.

Error trapping is provided by the **TRAP** command. Whenever an error is detected this command will cause the program to jump to the specified program line rather than 'bombing out'. You will then be able to find out what error has occurred and take the appropriate action. This command will make debugging your Basic programs very easy.

Finding out what the controllers are doing is also made very easy. **POK** will tell you

which direction a specified joystick is pointing in and whether the fire button is pressed. The position of the paddles and light pen is also easy to find out with the **POB** and **POA** commands respectively.

Machine code built will be pleased to hear that a machine code monitor is included. This will allow you to display, alter and move sections of memory. There is even a machine code assembler and disassembler. The Basic keywords **HIRE** and **DAC** will also prove to be very handy as they will allow you to convert decimal numbers to hex and vice-versa.

A number of new structure commands have been added to the standard **FOR/NEXT** loop. These include **GO/LOOP** which will repeat a section of your Basic program UNTIL a specific condition is met or **WHILE** a specific condition is met. **IF/THEN** will only allow one statement after the **THEN**

which are available. The six modes are, 40 column text, standard hi-map graphics, standard hi-map with split screen, multi-colour with split screen and 80 column text. As previously mentioned the 80 column screen can only be used with a monitor plugged into the RGB socket. The split screen modes are very interesting as they allow you to use a section of the screen in one of the graphic modes while still retaining a specified segment for text only. This type of feature has been used many times on the C64, especially in graphic adventures, but is now extremely easy to use on the C128.

Drawing lines or shapes on a graphics screen is also very simple. The **CIRCLE** command allows you to set up the colours that you require for any plotting etc. The **LOCATE** command can be used to position the graphics cursor at any point on the screen, and

DRAW will allow you to plot dots or draw lines in the specified colour. Shapes can easily be drawn as the **draw** command will allow you to string a number of points together by using the word **TO** as in

DRAW,10,10 TO 10,100 TO 10,10

BOX makes it extremely easy to draw rectangular shapes on the screen, all that is necessary is to specify the top right hand and bottom left hand co-ordinates together with the colour of the box. You can even specify if you want the box to be filled with a certain colour.

CIRCLE is used to draw circles, ellipses and 'other' shapes. This may seem to be a waste of space but when you see how complex the circle command can be you will understand what I mean. The **CIRCLE** command can have up to nine parameters, these are; the colour number, the centre of the circle, the X radius, the Y radius, the starting arc angle, the ending arc angle, the rotation in clockwise degrees and the number of degrees between segments. This does appear very complicated at first glance but playing around with the parameters will soon show you how versatile this command really is. Not all of the parameters need to be used every time that the command is used. The following example is from the manual and will draw a diamond shape on the screen:

CIRCLE 1,100,40,10,10,90

WIDTH can be used to set the width of any lines that you are drawing while **SCALE** will allow you to alter the size of your diagrams with ease. Another handy command is **PAINT** which will allow you to fill in any area of the screen with a specified colour.

A very limited form of window is implemented on the C128 through the **WINDOW** command. This allows you to set up a rectangular area on the screen in which all further screen updates will occur. The size of this rectangle can also be set up outside a program by using **ESC T** to set the top left

corner and **ESC B** for the bottom corner.

As well as having commands for producing pictures on the screen, there are also those that will tell you exactly what is happening on your display. The **BOX** will tell you which graphic mode the C128 is in at the moment. **LOCX** returns the current position of the graphic cursor or the colour of the graphic cursor. You can even find out the window parameters by means of the **WINDOW** command.

SPRITES

As with the C64 there are eight sprites available for use on the C128. These can be either hi-res, one colour, or multi-colour. However, unlike the C64, you'll never have to perform a single **POKE** to memory as Basic 7.0 supplies all of the commands that you'll ever need. You don't even need a sprite editor as there is one built into Basic.

SPRINT is the command that turns on the C128's sprite editor. On entering the command the screen clears and a sprite grid is displayed on the screen. Facilities available in the editor are; turning on and off individual modes, changing the colours, expansion of the sprite in X and Y directions, copying sprites and saving sprites. In fact all of the commands that you are likely to need are implemented. One fairly major omission from the sprite editor is the ability to move the sprite around in the grid. You cannot, for example, rotate a sprite or shift it left by one pixel. No doubt someone will develop a routine to perform these commands.

Another way of defining a sprite is to 'draw' the sprite onto the screen using the many drawing commands. The **SHARV** command can then read the sprite data into a string variable. Moving the contents of this string into sprite memory is also made very easy by the **SPRSHV** command, this moves the specified string into the sprite not required.

The **SPRINT** command allows you to turn on and off the individual sprites. **SPRINT** also lets you set the sprite colour, whether it passes over or beneath the background,

whether it is hi-res or multi-colour and if it is expanded in either the X or Y directions.

Moving a sprite around is also made child's play with the **MOVSPR** command. **MOVSPR** can take a number of forms. It can place a sprite at a specified point on the screen. It can be used to move a sprite to a new position relative to its old one, move a sprite a certain distance at a specified angle and, perhaps its most powerful use, it can set a sprite moving in a specified direction at specified speed and keep it moving. As you can probably see, the **MOVSPR** command will be a great boon to anyone who wishes to write a game program. Moving your latest deadly creation across the screen can now be done by one command rather than the numerous lines of code that C64 users are used to.

Looking after your sprites is no longer a problem as the **COLLISION** command will cause a jump to a specified line number when a sprite hits the background or another sprite. The **BUMPF** command can then be used to return the values of any sprites that have collided since the last **BUMPF** command.

Finding out the specific details of any sprite is also made easy with a number of commands. **SPRPCOL** returns the colour of a specified sprite. **SPRDX** will return the X co-ordinate of a sprite, very handy after a **BUMPF** instruction, and **SPRPUT** will tell you whether a sprite is on, off, expanded etc.

As you can see there are from the total number of the sprite manipulation commands that are mentioned above, writing any sort of program that uses sprites is now extremely simple. Before very long we should start to see some excellent graphic programs written totally in Basic.

Sound

The sound chip that is used in 128 mode is exactly the same as in the C64, the major difference being that there are now a large number of commands available to make control of it easy. There are five commands available for sound manipulation, **PLAYND** is used to place quick and easy sound

effects in your program. **SOUND** can have up to eight parameters. These are; the voice number (one to three), the frequency of the note, the duration of the note, whether the sound is to be incremented or decremented while playing, the minimum frequency the note can go to, how big the step up or down is, the type of waveform to use and the pulse width if you are using a square wave. As you can see, some very interesting effects can be made by using this command. Another command is designed to make the playing of music easy, this is the **PLAY** statement. **PLAY** allows you to set up a string of synthesizer control characters inside quotes. Characters allowed are the musical notes, **ABCDHFG**, characters which tell the synthesizer what type of note is playing and characters to specify the note, octave, envelope volume and filter. Two predefined envelopes are available using from **harpicoid** to **xylophone** and you are able to define your own using the **INVELOPE** command. **TEMPO** defines the speed of the song being played and **VOL** the volume. The command **REST** will also let you set up the filter parameters very easily.

Adding a musical accompaniment and sound effects to your programs is now very easy. Even a beginner will soon be producing music that are the same quality as those that the top programmers have been producing on the C64.

Verdict

Obviously I have not been able to cover all of the details of the C128 and its Basic, there are many commands that I have not covered. However, from the few that I have mentioned I think it should be fairly obvious that the C128 is a powerful machine, or should I say machines! The fact that it will run all C64 software, and that thousands of business packages are available with CP/M, make the machine a bargain for the beginner, hobbyist and businessman alike.

Commodore seems to have a winner.





Our resident linguist, David Janja, gives you a breakdown of Pascal packages for the C64.

PASCAL WAS INVENTED BY ONE MAN, Niklaus Wirth of the ETH Technical Institute of Zurich in 1970. It is a compiled language that was designed as an aid to teaching good programming practice.

Because the language is very concise, instructions found it easy to implement on their systems. Software houses also discovered that it was possible to implement Pascal on many home micros, hence the reason for its early appearance on the micro scene.

Program Body

Unlike Basic, where you have a free hand in program structure, Pascal requires the programmer to 'section' his programs. There are three main sections to a Pascal program.

PROGRAM - header declarations
BEGIN - Main body
END

The first section is the program header. Every Pascal program must start with the reserved word **PROGRAM**, which is followed by the name of the program. This can be optionally followed by I/O declarations, implemented in various ways in different compilers.

The next section is the declarations. There are a number of these, first there is the reserved word **CONST**, used to define a symbolic constant:

```
CONST
  PI=3.14159;
  AGE=22;
```

In the example, two constants have been declared, following the constant declarations, come the more common variable declarations:

```
VAR
  R: REAL;
  SUM,WIRCH,TOTAL: INTEGER;
  NAME: BOOLEAN;
  INITIAL: CHAR;
```

The four data types are integer, real, string and boolean. Pascal requires all variables to be declared explicitly, the Basic programmer can come as a bit of a shock. It's only easy in Basic to declare yet another variable as you need it, but in Pascal this is not the case. The good point in declaring variables is that you need to do some thinking and plan on how many variables you will need in the first place!

Language Lab

P·A·S·C·A·L

The next declaration is probably one of the most powerful features of Pascal - type definition. As you can see from above, there are four data types in Pascal. These are pre-defined data types, and if you wish you can declare more:

```
TYPE
  DAY=(SUNDAY, MONDAY, TUESDAY,
  WEDNESDAY, THURSDAY, FRIDAY,
  SATURDAY);
```

To make this a little clearer imagine the following:

```
TYPE
  INTEGER=(1,2,3,4,...,65535);
```

In other words, defining your own data type is a convenient means of giving a name to a ordered sequence of known elements. To add the icing to the cake, a SET can be declared which is a collection of objects of the same type:

```
TYPE
  CAPS=SET OF 'A..Z';
```

Now we can have the following in a VAR list:

```
VAR
  SETTER: CAPS;
```

The last two items in the declarations section of a Pascal program are procedures and functions. Basically, a procedure is a sub-program (a sort of sub-routine), which contains other statements and so on. Functions are means of declaring new operations that Pascal does not have.

So far, the main program body has not been discussed. As you might have already guessed, Pascal programming requires a lot of thought. This is a good thing because people tend to program at the keyboard without thinking first. Thinking about what data types and variables you'll need will encourage thought, and a good program can be the first result.

Pascal Syntax

The third section in a Pascal program is the main body of the program. Here, the first and last reserved words are **BEGIN** and **END**, with the final **END** followed by a full stop. I say 'final' because there are normally more than one **END**. To under-

stand this better, here is a very simple Pascal program:

```
PROGRAM Greeting;
BEGIN
  WRITELN('Hello, Your Commodore
  model?');
END
```

Notice that there is no declaration section. The two statements in our small example are the first line and **WRITELN**. Statements are separated by a semi-colon. The exception to this case is the statement preceding and **END**.

```
PROGRAM Greeting;
BEGIN
  WRITELN('Hello');
  WRITELN('How are you today?');
END
```

In the example, the first statement after **BEGIN** ends with a semi-colon because the next line contains another statement. Now look at this example:

```
PROGRAM Count;
VAR
  I: INTEGER;
BEGIN
  WRITELN('Watch this!');
  FOR I:=1 TO 10 DO
    WRITELN(I);
END
```

This simply prints 'Watch this!' followed by 'I' printed 10 times. However, if I wanted to print 'I' followed by 'I' on the next line a nested **BEGIN..END** has to be used:

```
PROGRAM YingYang;
VAR
  I: INTEGER;
BEGIN
  WRITELN('Watch this!');
  FOR I:=1 TO 10 DO
    BEGIN
      WRITELN('I');
      WRITELN('Yang');
    END;
  WRITELN('That's all folks!');
END
```

The two statements between the second **BEGIN..END** are considered as a compound statement (i.e. treated as one). This example also demonstrates the use of indentation. This is NOT compulsory, but it does make the program easier to read and



follow through logically. The normal rule of thumb is that when nesting occurs (more BEGIN) you indent, and as the END is reached on the same column indentation occurs:

```
BEGIN
statements
BEGIN
statements
BEGIN
statements
END
END
END
```

Procedures and Functions

Tables one and two list the standard Pascal reserved words as well as pre-defined procedures and functions. There are not many, but they are pretty powerful. Pascal provides the features to define your own procedures and functions made up from existing procedures and functions.

In essence, procedures and functions are mini-programs. They may have their own declarations and program blocks just like the main program. Although similar, there are a couple of differences between the two. Procedures do not have to have a parameter passed to them, although it is possible to pass parameters to and from procedures. Functions on the other hand, must have a parameter and can be used in comparisons while procedures cannot.

Here is an example of a program that uses a procedure. All it does is print the numbers one to 10, 10 times:

```
PROGRAM Test;
VAR
  I : INTEGER;
PROCEDURE Count;
VAR
  J : INTEGER;
BEGIN
  FOR J:=1 TO 10 DO
    WRITE(J)
  END;
BEGIN
  FOR I:=1 TO 10 DO
    Count
  END;
```

Notice that the procedure and the main program use a variable with the same name. This is OK, because variables are local to procedures and functions. Also note that the procedure 'Count' is called from the main program just like any other procedure (no line numbers like Basic).

A function is declared in a similar manner, although its operation is different:

```
PROGRAM Table;
VAR
  I : INTEGER;
FUNCTION Square (N : INTEGER) :
  INTEGER;
```

```
BEGIN
  N:=N*N;
END;
BEGIN
  FOR I:=1 TO 10 DO
    BEGIN
      WRITE(I);
      WRITE(N/Square(I))
    END;
  END;
```

In the example, I have used the function 'Square' directly, but as with external functions it is possible to pass the result to a variable.

Control Structures

Commodore Basic is a bit limited as far as control structures are concerned. Pascal on the other hand, offers the programmer some very elegant means of controlling program flow.

One control structure which has already been covered in the examples is the FOR...DO loop, which is similar to the Basic FOR-NEXT:

```
FOR I:=1 TO 10 DO
  WRITE(N);
```

DOWNTO is used to reverse the loop:

```
FOR I:=10 TO 1 DO
  WRITE(N);
```

To include more than one statement within the loop boundaries, a compound statement is used:

```
FOR I:=1 TO 10 DO
  BEGIN
    Statement;
    Statement;
    "
    "
    Statement
  END;
```

One last point about a FOR...DO loop is that unlike Basic, Pascal does not like the index (the variable after the FOR) to be altered within the loop itself.

Probably the major drawback with the FOR...DO type of loop is that you have to specify an end to the loop. That is, a FOR...DO loop must have fixed boundaries - even if passed by variables. Pascal offers a couple more control structures which are more flexible.

The first of these flexible control structures is REPEAT...UNTIL:

```
REPEAT
  A:=A+1;
  WRITE(N);
UNTIL A=5;
```

Notice that A would have been initialised before entering the REPEAT loop. Also note that compound statements do not have to be used. Instead, statements are merely separated by the semi-colon. Can you see why this is the case?

You can see from the example that a boolean test is performed after the UNTIL. Any of the boolean operators can be used in this test including '<', '<=' and so on. The most important point worth remembering about the REPEAT...UNTIL loop is that the statement(s) within it will be performed at least once. This is because the test is done at the end of the loop.

The second 'even-so-flexible' control structure is the WHILE...DO loop which takes the following form:

```
WHILE level <= level DO
  BEGIN
    level:=level+1;
    "
    "
  END;
```

Notice that the boolean test is performed before any statements are executed so that if the boolean test is false no statement will be executed. A final point to note is that, unlike the REPEAT...UNTIL loop, multiple statements must be treated as compound statements i.e. with a BEGIN...END.

The final control structure to be considered is the CASE statement. This is used in situations where the number of alternatives is greater than two. It is best understood by example:

```
CASE month OF
  1:WRITE(N)('January');
  2:WRITE(N)('February');
  3:WRITE(N)('March');
  4:WRITE(N)('December');
END;
```

In the example the variable 'month' has a certain value. Depending on what that value is, perform a different action. That is exactly what the CASE statement does. If 'month' is equal to five, then 'May' will be printed, and so on.

Oxford Pascal Oxford Computer Systems Disk

Not all compilers produce native machine code, some produce what is known as P-code. The version of Pascal from Oxford Computer Systems does just that. The result is an executable program that doesn't run very fast. However, it should be noted that there are numerous Pascal P-code compilers because they are easy to implement.

Although Oxford Pascal is quite expensive, you do get a lot for your money. First, it follows the Pascal standard almost to the letter. Because of this it

could be used as a serious Partial Training tool.

A major problem with disk based compilers is the time it takes from writing the program to running it. Because of this, Oxford Pascal offers two methods of running Pascal programs.

The first method is to use the resident compiler. This is the default option when the compiler is first loaded. In this mode it is possible to write, amend, compile and run a Pascal program without having to access the disk drive. This allows learners to get their feet wet and generally muck about

The second method of operation is disk mode. Here, a program has to be developed in the standard method. That is, entered, saved to disk, compiled and executed if any errors occur. This mode does offer numerous advantages though. Programs can be much larger as compilation is from disk. Other advantages include data file handling, the availability of the full computer system, external procedures and so on. Object code can also be converted to a standard object code.

Machine-dependent features include a layer of ports and poles, colors and sound and some graphic commands. Most notable of these is the window command that allows the screen to be split between the high-resolution graphic screen and the text screen.

Papyrus 116
 Chrysostomus 116
 Roman

Pascal 84 and Oxford Pascal are so similar in many ways that most of the comments in these reviews apply to both packages.

As with *Colored Pascal*, *Pascal 64* offers an almost complete definition of Pascal as defined in the *User Manual and Report by Martin & Jerosol*. It is, however, a cassette version and does not produce stand alone code, i.e., does not have a disk mode).

The Pascal source is entered in an editor which is very similar to the standard C++ editor.

There are a few differences and additions. Namely, source code can be entered with indentation, thus showing the program structure. Additions to the standard editor include commands such as search and replace, auto line-numbering, comments, delete and so on.

The source program can be compiled with or without a listing, which can be directed to the printer. The object code can then be run and/or saved to tape; that is, stand alone programs cannot be produced, it is necessary to have the computer in memory when recording any object code.

Addressing another standard are similar to what Oxford Pascal offers. But the general purpose (GPAW) command in Pascal 64 is much faster (see benchmarks). Additional features include sparse handling, the ability to read a file, and the joystick.

Figure 1

Both Oxford Pascal and Pascal 84 have common faults. First, both packages are slow (see benchmarks). In fact neither of the two compilers is that much faster than Basic. This is a great pity as one of the advantages of Pascal is its speed.

Other problems include flickering of the high-resolution graphics screen, but the biggest fault is that this screen is divided into 250 by 300 pixels, why not the full 320?

Planned 6-8
Plural 10-12
Plural 10-12

When I first heard about this package I thought, "Great, a true Pascal compiler." However, after using it I have mixed feelings, it's both very good and really weird.

The package consists of a disk and 70-page poorly written manual/user guide. The software was written by a German company called Data Reiter and the text of the manual and software have suffered through translation.

This compiler is very disk-intensive and takes about three steps before a program can be run. The tasks involved in developing a program with this package are: write the source, compile the source, link the object code and save object code to disk. On the good side the compiler produces compact stand-alone code, but don't expect to achieve that in the interim.

The biggest let-down with this package is the lost stage of producing a program. There is no editor and it is necessary to enter the source code using the standard editor. Not only is this a bother (there are no extra editing commands), but it is a disaster. The reason for this is simple. Part of the "beauty" of Pascal is the ability to write programs that are indented. This makes the program look neater, easier to read and identify. Because Pascal 64 requires the source to be entered using the standard 54 editor no indentation is allowed (unless you are proceeding by a "C" which makes the source look ugly).

Another weird thing about the package is that all Pascal keywords must be followed by a space character. This is non-standard, and the more experienced programmer will be frustrated by this, while the beginner will pick up a bad habit. If a space is required, is keyword

Although the review so far has been negative, things get better after the source has been entered. Once the code has been compiled and linked a machine code file is produced and can be run stand-alone.

The computer itself is the best of the three packages reviewed, offering more advanced features. These include comprehensive file handling, external procedure support, high-resolution plot

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An integer command enables faster execution if only integers are being handled. Another impressive feature is the ability to run a procedure as an interrupt. The constraints on this are rather limited, but it could be useful.

Table 1. Panel Regression Results

Here is a list of Pascal reserved words. Note that this list is the required set of words and that some versions may have more – but not less.

AND, ARRY, RCIN, CASE, CONST,
COPY, DO, DOWNDO, ELSE, END, FILE,
FOR, FUNCTION, GOTO, IF, IN, LABEL,
NEXT, NEL, NOT, OR, ON, PACKED,
PROCEDURE, PROGRAM, RECORD,
REPEAT, SET, THEN, TO, TYPE, UNTIL,
VAR, WHILE, WITH

Table 1 — Standard Functions and
their notations

Every version of Pascal should have the following functions and procedures (with the possible exception of `WRITE` and `DISPOSE`). All implementations of Pascal on the 48 have more pre-defined procedures which deal with colour and fonts. Note that the brackets indicate an assumption.

CATS, PAGES, PLUGS, BLIND, REASON,
BENTLE, KIDNOTES, WHITE, WRITING,
ABAND, ARCTICAN, CORN, ESCAPE, LIND,
SING, NEGRO, HOURS, COPI, FOUND,
ODDS, CHAIR, ORDIN, BOUND,
BRUNCE, PAPER, UNPACK, NEW,
DISPOSAL, PRIDE, SUCCE

Summary

If you intend to learn computer science then I would strongly recommend that you get a Pascal compiler for your 64. Pascal has a small amount of reserved words, yet many of the up and coming 16th generation languages incorporate these ideas.

As far as recommending one of the three packages I can only suggest that if you wish to learn Pascal, then Oxford Pascal is by far the best. Even though 'Orpheus' Pascal 64 is very similar, the disk operation within Oxford Pascal is a much more pleasant experience. Oxford Pascal is a bit pricier, as Orpheus' Pascal 64 would be a more useful second.

For the more experienced programmer I would recommend Int Publishing's Pascal 64. Even though the user interface and disk space requirements are off-putting, I say this because the results are quite fast, and it does have a number of advanced features not found in the others, such as:

David Janda is prepared to discuss this subject further through electronic mail. He can be contacted on the following

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then it's time to

then it's time to
VENTURE INTO THE UNKNOWN...

THE WARD AND THE PRINCESS

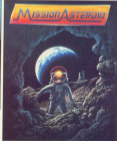
OLIVER AND THE GOV PERS A PART

Challenged by the ever-
changing and often chaotic
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is what makes it a
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References

It's your duty to be the person in a team willing to take the course. The time is the material. The material is quality and care, and your hands are polished. It is to be perfect. The time is a professional time in which to answer your questions. Be quick and careful. The time is the time you have spent.



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MACH 1

THE AIM OF THIS SERIES OF programs is to provide the reader with a set of tools to aid in the production of 6801 machine code programs on a C64 suitably equipped with aTAN disk drive.

There are three separate programs: a Machine Language Monitor/Editor, a Macro Processor and an Assembler. The Monitor is essentially the control program from which the other two may be called upon to process source code written using the Editor.

The Macro Processor is not a full implementation since it does not handle conditional processing. However, it does allow sections of source code to be written as "macros" with parameters for later inclusion in source code programs.

The Assembler is a two-part type which produces an executable disk file which may be loaded into memory by using a simple Basic command:

```
LOAD "Filename",A,1
```

The programs are disk-based since it was necessary to have the random access and reliability that a disk drive affords.

I will first deal with the Monitor/Editor program and then the Macro Processor and Assembler in turn.

The Monitor

The four Basic listings, when loaded and RUN in sequence 1-4 will POKE the complete Monitor/Editor program into memory. Each listing contains REM statements to show where the various sections of code begin and end. I suggest that you type in and save all four programs before you attempt to generate the code. A word of caution here; check

Monitor Command Summary

Command	Description
HELP [A,C,D,E,F,G,H]	Input processor register values. The H command outputs a similar format allowing free use of the C64 screen editor.
*addr1,addr2,...,byte	Input N consecutive byte values into memory starting at addr1. The M command outputs a similar format allowing free use of the C64 screen editor, initialises, performs a warm start, displays contents of memory between addr1 and addr2, displays processor register values.
M addr1,addr2	sets to Basic command mode, restores processor register values and begins execution at addr1.
R	copy the contents of memory block addr1 - addr2 to a block starting at addr1.
S	fill the memory block (addr1 - addr2) with the value byte.
G addr	
T addr1,addr2,addr3	
F addr1,addr2,byte	

Note that in the above commands, the value byte may be given in MACH1 format by preceding the character by the apostrophe ('). For example, F 5000,5000, A will fill the block 5000-5000 hex with the value 41 hex, the ASCII code for "A".

L filename	loads a file into memory at its original address.
S filename addr1,addr2	save the memory block (addr1 - addr2) to a disk file with name filename. filename should not contain spaces.

Monitor Command Summary — Multiple Letter Group

RESET	causes the machine to cold start
DIR	displays current disk directory
CAT	displays current disk directory
DEBR	displays disk drive status
INIT	initialises drive (disk 1 command)
COMPACT	validates disk (disk 1 command)
FORMAT [diskname,IO format] disk [disk N command]	
COPY filename,filename	copies a file (disk C command)
filename	
RENAME filename filename	renames a file (disk R command)
DELETE filename	deletes a file (disk D command)
MCATCH filename	sets default I/O mode to hex
HIS	sets default I/O mode to decimal
DIC	defaults output device = PRINTER
TTY	defaults output device = SCREEN
YOU	exits Editor mode
EDITOR	

your typing carefully at no checksum facility is provided.

When all four are ready to be RUN, load and execute them each in turn then give the following Basic direct command:

```
POKE141,0:POKE144,100:POKE  
41,128:POKE48,142:SAVE"  
MONITOR",A,1
```

Having done this, type:

```
POKE141,1:POKE144,8:NIM
```

You should now have a copy of the actual program on disk and are ready to test it out.

Testing the Monitor

Enter the monitor by loading the direct Basic command:

```
SYS 11200
```

You should be given the message:

```
CONVINCINGRE 64 UTILITY  
SERIES  
MONITOR (D)E(B) C(S, V)Z  
(C) 1985 J.D.C.
```

followed by a " " prompt and a flashing cursor. You are now in Monitor command mode. It is from this that you will command most of the functions of the Monitor/Editor and the other programs.

A summary of commands is given later but for now try the following commands:

Type DEBR, followed by return, the disk status is given on screen in a form similar to:

```
DEBR DR, 0, OK,0,0
```

where DEBR DR, indicates that this is a disk status report. Machine reports are prefixed by MACHINE.

Now type DIR. The directory of the current disk will be displayed on screen in a format similar to that obtained by using the most usual Basic method LOAD " ",A.

Note that some commands, such as COPY and RENAME, automatically produce a disk status report to show whether or not the command has been carried out successfully.

The format of the disk commands: SCRATCH, COPY etc. are the same as are given in the SH1 disk users' manual. Note that in all cases, spaces, and not quotes, are required around filenames. For example, the command to save a block of memory to disk is S. Thus the format is:

```
S filename addr1,addr2
and
S "filename" addr1,addr2
```

Note type 1. This will perform a warm start into the monitor. If you type 2, the machine will monitor BASIC. To get back into the Monitor, simply type the SYS 35000 command again.

One thing to note is that the 4500 BRK vector is now set to jump into the monitor. This means that you may insert BRK instructions into your machine code programs to act as STOP for debugging purposes. To see the effect of this, type the following:

```
FORN24-SYS 2
```

A zero byte is the code for the 4500 BRK instruction. You will be given the entry message as before but this time it will be preceded by

```
***BRK***
```

indicating that a BRK instruction was encountered during execution of a machine code program.

Any other words typed in are assumed to be "internal" commands (i.e. disk files which all sit in memory). The programs MACRO and ASMEDITOR are examples of these. When you want to call the Macro Processor for example, assuming you called the program MACRO, you simply type MACRO plus a couple of filenames and the Macro processor will be loaded and run. An internal command is assumed to begin at address 0000 hex. Therefore, if you want to write a program to act as an internal command, it should have a start address of

Editor Commands

Command	Description
A	Auto line numbering (this is a useful feature since it does away with the need to type in line numbers. Two formats are valid. 1 A : start 00, increment 10 2 A10,20 : start 10, increment 20 Format 2 may of course use other numbers.
D	Delete lines (there are two methods of line deletion: 1 The usual Basic method, type a line number 2 The D command. An example would be D20-60 which would delete lines 20 through to 60. Remember lines this simply renumbers the lines of a source code program. The format is the same as for the A command. Use program lines - the RUN/STOP key may be used to terminate the listing. If a line number is supplied, listing will commence from that line e.g. D200 will begin listing at line 200.
M	Merge file - the format is filename. The file named will be merged onto the end of the file currently in memory.
S	Scratch (delete) a file - this is similar to the Basic command FILE.
I	Initialise - rewrites editor deleting any file currently in memory.
-	Exit editor - there are three formats for this command. 1 * - : save file and exit. 2 * : save file without save. 3 filename : save file with a new name and exit.

0000 hex. At the end of execution, a JMP \$0200 instruction will cause a re-entry to the monitor.

The Editor

The Editor is provided so as to allow preparation of source code in the correct format for the Macro Processor and Assembler. The basic idea behind the Editor screen format is that source code symbols, operands and mnemonics all have defined areas in a source line. These areas are known as FIELDS and both the Macro Processor and

Assembler expect to find their source code arranged in these fields.

On a normal C64 screen, there are 25 rows of 40 characters. The editor arranges the screen such that there are four fields of 10 characters each numbered one to four starting at the left side. Since the normal screen editor will accept up to 80 characters (i.e. two lines of text, the last field - field four - may extend for up to a maximum of 50 characters. Field one is only used by the Editor to accept and display line numbers. It is not actually stored in the final source

program. Field two is the SYMBOL or LABEL field, field three is the INSTRUCTION or MNEMONIC field and field four is the OPERAND field.

The functions of these fields will become clearer as we go on to explain the Macro Processor and Assembler.

A typical Editor screen layout is shown below. The top line is for guidance only and is not on screen.

```
FIELD 1 FIELD 2 FIELD 3 FIELD 4
1000  LABEL1,SYMBOL  DELAY
1005  IDA  $40
1010  A50  A
etc....
```

If you're wondering how you are going to keep all the field entries in the right places then read on. When in edit mode, the function key F1 is used as a TAB key. When pressed, it will advance the cursor from its present position to the start of the next field. For example, suppose the line 1000 in the above example was being typed in. The line number would be typed in and the F1 key pressed. The cursor would be advanced to the start of field 2 - the L of LABEL1. Pressing F1 again would advance the cursor to the start of field 3 - the S of SYM and so on.

This feature coupled with an auto line numbering facility makes for easy code entry.

Other facilities include line renumbering, block line delete, source code file merging and single line delete. A program is entered in a similar fashion to a Basic program with the line numbers. These numbers are for editing purposes only and do not affect the final object code generated by the assembler. All the normal Commodore screen editing facilities are supported by this editor.

Entering and Leaving the Editor

While in Monitor command mode, enter the command EDITOR. The message EDITOR, ENTER filename will appear. You should enter the name of the file you wish to use. If the file exists on the current disk the Editor will read it in and you will be able to work on it. If however the file does not exist on the current disk, the message

NEW FILE will be printed. In both cases, a flashing cursor (no prompt) will signify Editor command mode.

Before going on to explain the Editor commands, a word or two about leaving it. The name entered in the filename, is stored by the editor. At the end of the editing session the user may simply enter the command ^ and the file is saved back to disk. An auto disk validate is carried out.

This is done to prevent problems associated with the "541" 8" bug, in some cases it may take a long time to validate a disk especially if it is

getting dull. Some of you may find this a bit of a nuisance but I personally prefer it to a corrupted disk. If you want to do away with this facility, refer to listing seven which contains details on removing it. (see Editor Commands).

When you have the Macro Processor and the Assembler complete, I will give some programming examples to let you get used to the operation of the Editor and its formats. Next month I will give listings of the Macro Processor and a description of Macros and Macro processing.

Monitor Part 1

```

5 REM ** JUMP TABLE **
6 REM *****
10 DATA 75,114,137,76,152,135,76,1
11,135,76,160,134,76,135,132,76
20 DATA 156,132,76,24,132,76,51,13
2,76,17,132,76,35,132,76,45
30 DATA 132,76,105,135,76,18,135,7
6,16,141
34 REM *****
35 REM ** COMMAND & MESSAGE TABLES
**
38 REM *****
40 DATA 77,0,82,0,71,0,84,0,70,0,7
6,0,83,0,43,0,42,0,73,0,88,0
50 DATA 82,85,83,88,84,0,88,73,82,
0,87,85,84,0,83,87
60 DATA 82,85,84,87,72,0,70,75,82,
77,85,84,0,73,78,73
70 DATA 84,0,67,73,80,83,0,82,63,7
8,65,77,63,0,84,83
80 DATA 80,69,0,67,79,77,80,66,67,
84,0,69,63,82,82,0
90 DATA 72,69,88,0,69,69,67,0,69,6
8,73,84,79,82,0,86
100 DATA 69,86,0,84,84,88,0,266,83
,133,45,133,114,134,50,134
110 DATA 248,133,6,130,3,130,208,1
33,171,133,114,137,158,134,258,252
120 DATA 163,136,163,136,37,135,60
,135,101,135,63,135,66,135,46,136
130 DATA 98,136,9,133,223,135,226,
135,91,139,150,136,156,136,13,10
140 DATA 67,79,77,77,73,68,73,82,6
9,32,24,52,32,85,84,73
150 DATA 76,73,84,83,32,83,83,82,7
3,69,83,46,13,10,77,79

```

Monitor Part 1

```

160 DATA 76,73,84,79,82,32,69,68,7
3,84,79,62,32,79,46,83
170 DATA 46,38,86,49,46,30,13,10,4
0,67,41,32,48,67,66,53
180 DATA 32,83,46,68,46,67,46,13,1
0,13,10,0,13,13,10,42
190 DATA 42,32,66,69,69,65,75,32,6
9,79,84,82,85,32,42,42
200 DATA 13,10,0,42,79,76,46,13,10
,9,13,10,78,65,87,32
210 DATA 70,73,78,69,13,10,13,10,0
,13,10,69,68,73,84,79
220 DATA 82,13,10,0,13,10,42,42,65
,66,62,79,82,42,42,13
230 DATA 10,0,13,10,77,65,67,72,73
,78,69,32,69,32,0,68
240 DATA 73,83,75,32,68,62,32,68,3
2,0,13,10,32,32,32,32
250 DATA 80,67,32,32,83,82,32,65,6
7,32,88,82,32,85,82,32
260 DATA 83,80,13,18,62,43,32,0,13
,10,68,78,84,63,62
264 REM *****
****
265 REM ** INPUT EVALUATION SUBRT.
**
268 REM *****
****
270 DATA 32,70,73,76,63,78,65,77,6
9,32,0,238,84,48,68,255,32
280 DATA 136,173,76,247,183,201,48
,144,18,201,71,176,14,201,58,178
290 DATA 3,41,16,36,201,85,144,3,2
33,55,58,76,78,178,32,121
300 DATA 0,32,183,131,72,32,116,0,
32,24,130,144,20,104,10,10
310 DATA 10,10,133,8,32,121,0,32,1
81,131,6,2,133,2,76,116
320 DATA 0,104,133,2,66,32,206,131
,168,2,132,20,32,121,0,32
330 DATA 24,130,178,1,96,32,206,13
1,168,20,133,21,168,2,133,20
340 DATA 96,32,27,130,144,1,96,201
,65,144,6,201,71,178,2,56
350 DATA 96,24,36,201,48,144,250,2
01,58,178,246,66,96,32,13,177
360 DATA 144,241,96,163,0,133,80,1
83,21,32,121,0,201,39,208,6
370 DATA 32,115,0,133,20,96,173,17
4,2,240,3,76,245,131,32,121
380 DATA 0,78,179,131
1000 FORS=33280 TO 33876
1010 READA,POKEA,A
1020 NEXT
1030 PRINT"FINISHED"

```

Monitor Part 2

```

5 REM ** OUTPUT SUBROUTINES **
6 REM *****
8 DATA 100,32,76,210,255,168,74,7
9,210,255,168,13,32,210,255,168
20 DATA 10,76,210,255,168,147,76,2
10,255,72,74,74,74,32,128
30 DATA 132,32,210,255,104,41,15,3
2,129,132,76,210,255,201,10,144
40 DATA 3,105,54,55,3,48,92,173,17
4,2,240,0,152,32,103,132
50 DATA 138,76,103,132,152,76,208,
188,72,173,174,2,240,4,104,76
60 DATA 108,132,104,134,253,132,25
4,170,188,0,32,203,183,164,254,188
70 DATA 253,56,163,6,160,6,162,15,
140,32,208,141,134,2,142,33,208,55
74 REM *****
84 REM ** ERROR HANDLING **
76 REM *****
86 DATA 138,18,3,108,2,3,72,32,180
,138,168,88,180,131
90 DATA 32,30,171,104,10,170,168,1
28,133,157,188,38,163,133,34,188
100 DATA 35,163,133,35,32,204,253,
183,0,133,13,32,220,170,180,0
110 DATA 177,34,72,41,127,32,71,17
1,200,104,16,274,32,122,168,32
120 DATA 18,138,168,2,3,32,18,130,
183,111,160,131,32,30,171,152
130 DATA 15,32,188,253,32,228,253,
32,210,255,201,13,208,242,152,0
140 DATA 32,188,255,32,18,130,108,
2,3
144 REM *****
146 REM ** MONITOR O.S. SUBRT.
148 REM *****
148 DATA 183,122,160,131,32,30,171
160 DATA 172,168,2,174,167,2,32,12
,130,162,0,32,83,132,188,168
180 DATA 2,32,15,130,232,224,5,208
,242,32,18,130,108,2,3,32
170 DATA 21,130,168,20,133,251,163
,21,133,252,32,253,174,32,21,130
180 DATA 32,18,130,168,32,32,210,2
55,163,48,32,210,253,32,84,132
190 DATA 164,252,165,251,32,12,130
,160,0,32,88,132,177,251,32,15
200 DATA 130,200,152,8,174,243,32,
225,255,240,22,132,24,101,251,133
210 DATA 251,183,252,105,0,183,252
,187,21,144,187,185,251,187,20,144
220 DATA 181,32,18,130,108,2,3,32,
21,130,183,20,133,251,165,21
230 DATA 133,252,160,0,138,80,32,2
33,174,32,21,130,164,90,165,80
240 DATA 145,251,200,132,90,132,8,
144,235,108,2,3,32,21,130,165
250 DATA 20,168,21,141,167,2,142,1
68,2,162,0,134,253,32,253,174
260 DATA 32,21,130,165,20,165,253,
157,169,2,232,134,253,224,6,144
270 DATA 234,108,2,3,32,21,130,165
,20,165,21,133,251,134,252,32
280 DATA 253,174,32,21,130,165,20,
165,21,133,253,134,254,32,253,174
290 DATA 32,21,130,160,0,165,20,14
5,251,230,251,208,2,230,252,185
300 DATA 251,187,253,208,240,165,2
52,187,254,208,234,108,2,3,32,21
310 DATA 130,188,20,168,21,133,251
,134,252,32,253,174,32,21,130,165
320 DATA 20,168,21,133,253,134,254
,32,253,174,32,21,130,160,0,177
330 DATA 251,175,20,230,251,208,2,
230,252,230,20,208,2,230,21,185
340 DATA 251,187,253,208,234,165,2
52,187,254,208,228,108,2,3,32,131
350 DATA 0,240,13,32,21,130,165,20
,166,21,141,167,2,142,168,2
360 DATA 174,173,2,184,173,168,2,7
2,173,167,2,72,173,168,2,72
370 DATA 173,170,2,174,171,2,172,1
72,2,64,168,150,162,227,171,0
380 DATA 3,142,1,3,183,131,162,184
,141,2,3,142,3,3,174,173
390 DATA 2,154,163,128,133,167,76,
123,227
400 REM *****
1000 FOR% =33876 TO 34482
1010 READ%:POKE%,A
1020 NEXT
1030 PRINT"FINISHED"

```

```

5 REM *****
***
6 REM I/O SUBROUTINES
7 REM *****
**
10 DATA 32,121,0,162,0,164,122,132
,93,165,0,2,240,15,201,32
20 DATA 240,11,200,232,224,30,144,
241,162,23,108,0,3,132,122,224
30 DATA 0,208,5,162,8,108,0,3,164,
53,55,32,5,139,134,2
40 DATA 152,170,168,58,202,157,0,2
,202,168,54,157,0,2,134,84
50 DATA 166,2,232,232,134,2,166,54
,133,50,163,2,133,51,164,2
60 DATA 163,0,145,30,55,163,15,162
,8,160,15,32,166,255,163,0
70 DATA 32,163,255,76,132,255,163,
15,76,166,255,162,15,32,201,255
80 DATA 165,54,160,2,32,30,171,162
,0,76,201,255,168,83,44,163
90 DATA 76,44,163,67,44,163,82,133
,54,32,232,134,32,40,135,76
100 DATA 8,133,141,70,2,163,0,141,
71,2,163,1,133,2,163,70
110 DATA 133,54,76,40,135,163,86,4
,4,163,73,32,73,135,168,2,3
120 DATA 32,3,130,138,72,152,170,1
04,160,2,76,163,255,163,1,162
130 DATA 8,160,1,76,166,255,32,33,
130,32,122,135,163,0,32,213
140 DATA 255,171,5,162,4,108,0,3,1
08,2,3,32,33,130,32,122
150 DATA 135,163,32,32,255,174,32,
21,130,165,20,165,21,72,138,72
160 DATA 32,253,174,32,21,130,165,
20,164,21,164,133,21,104,133,20
170 DATA 165,1,43,254,133,1,163,20
,32,218,255,8,168,1,9,1
180 DATA 133,1,40,144,5,162,24,108
,0,3,32,163,255,208,246,168
190 DATA 2,3,166,255,44,168,0,141,
174,2,163,51,180,131,32,30
200 DATA 171,108,2,3,32,207,255,72
,32,163,255,41,54,208,2,104
210 DATA 56,104,162,0,32,168,255,1
68,2,32,195,255,108,2,3,163
220 DATA 2,162,8,160,2,32,166,255,
32,33,130,24,32,132,255,178
230 DATA 11,32,183,255,208,5,55,16
2,2,76,168,255,162,4,108,0
240 DATA 3,32,12,136,32,204,255,32
,131,136,32,241,135,32,241,135
250 DATA 32,241,135,32,241,135,32,
241,135,32,241,135,160,0,32,241
260 DATA 135,40,231,153,0,2,200,20
1,0,208,243,32,204,255,32,160
270 DATA 136,163,0,160,2,32,30,171
,32,18,130,32,204,255,32,131
280 DATA 136,32,225,255,240,140,16
0,0,76,81,136,173,175,2,208,1
290 DATA 55,162,200,76,201,255,162
,2,76,135,255,162,0,142,175,2
300 DATA 32,201,255,163,200,32,155
,255,96,32,136,136,108,2,3
310 DATA 163,200,141,175,2,162
311 REM *****
****
312 REM THIS IS THE DEVICE NUMBER
FOR
313 REM THE PRINTER
314 REM ***
315 DATA 4
316 REM ***
317 REM CHANGE TO WHATEVER YOU NEE
D
318 REM *****
****
319 DATA 160,1,32,166,255,163,0,32
,168,255
320 DATA 168,4,141,147,2,32,132,25
5,162,200,32,201,255,108,2,3
330 DATA 32,136,136,163,32,133,231
,163,48,133,252,168,2,162,251,160
340 DATA 0,32,168,255,163,1,162,8,
160,0,32,166,255,32,132,255
350 DATA 141,10,72,165,184,32,135,
255,104,76,5,133,160,3,132,183
360 DATA 165,184,32,136,255,32,207
,255,133,87,32,183,255,208,105,32
370 DATA 207,255,133,88,32,183,255
,208,55,164,183,136,208,224,132,18
3
380 DATA 32,207,255,72,32,183,255,
170,104,224,0,208,75,164,163,152
390 DATA 80,176,53,153,0,2,170,210
,4,230,183,208,207,162,0,32
400 DATA 168,255,166,87,165,88,32,
205,165,163,32,32,210,255,160,0
410 DATA 165,0,2,250,8,32,210,255,
208,208,215,32,18,130,182,0
420 DATA 32,158,255,32,225,255,240
,16,32,220,255,201,32,208,5,32
430 DATA 238,255,240,231,160,2,208
,164,162,0,32,158,255,165,184,32
440 DATA 195,255,76,3,133

```

Monitor Part 3

```

944 REM *****
***
945 REM ENTRY POINT/MAIN LOOP
946 REM *****
***
948 DATA 168,150,162,137,141,22,3,
142,23,3,165
950 DATA 158,162,132,141,0,3,142,1
,1,163,213,162,137,141,2,3
952 DATA 142,3,3,234,234,234,76,18
8,137,104,141,172,2,104,143,171
954 DATA 2,104,141,170,2,104,141,1
63,2,104,105,255,141,167,2,104
956 DATA 105,255,141,169,2,169,28,
160,131,32,30,171,76,114,137,32
958 DATA 162,132,168,1,141,174,2,1
68,130,162,0,134,51,134,55,133
960 DATA 52,133,56,163,206,160,130
,32,30,171,166,142,173,2,32,162
962 DATA 132,163,0,133,157,32,35,1
35,163,52,32,210,255,174,173,2
964 DATA 154,32,36,165,134,122,132
,123,32,115,0,201,62,240,249,201
966 DATA 0,240,219,165,122,134,93,
160,0,132,2,165,42,130,201,255
968 DATA 240,65,201,0,240,65,221,0
,2,208,4,232,200,208,236,105
970 DATA 42,130,240,3,200,208,248,
200,165,122,230,2,76,8,138,169
972 DATA 0,2,32,18,177,144,6,165,4
2,130,76,18,138,165,2,10
974 DATA 134,122,170,169,162,130,1
33,20,169,153,130,133,21,32,18,135
976 DATA 108,20,0,165,93,133,122,1
63,2,133,123,32,18,135,32,30
978 DATA 130,32,122,135,24,168,0,3
2,213,255,176,6,32,35,135,76
980 DATA 0,144,162,4,108,0,3
1000 FOR S=34483 TO 35443
1010 READ A:POKEA,A
1020 NEXT
1030 PRINT"FINISHED"

```

Monitor Part 4

```

5 REM *****
***
6 REM EDITOR SUBROUTINES 1
7 REM *****
***
10 DATA 162,10,160,4,165,0,2,232,2
00,153,251,1,169,251,1,200
20 DATA 243,153,253,1,198,123,169,
258,133,122,56,120,163,116,162,138
30 DATA 141,4,3,142,5,3,169,240,16
2,138,141,2,3,142,3,3
40 DATA 162,258,133,123,169,104,16
2,140,141,20,3,142,21,3,169,218
50 DATA 162,141,141,0,3,142,1,3,98
,56,120,169,124,162,165,141
60 DATA 4,3,142,5,3,169,32,133,128
,169,218,162,137,141,2,3
70 DATA 142,3,3,169,49,162,234,141
,20,3,142,21,3,169,198,162
80 DATA 132,141,0,3,142,1,3,98,56
84 REM *****
****
85 REM ** EDITOR MAIN LOOP
86 REM *****
****
88 DATA 108,2,3,32,35,135,32
90 DATA 18,135,32,96,165,134,122,1
32,123,32,115,0,170,240,237,162
100 DATA 258,134,58,144,68,201,42,
208,3,76,252,138,201,76,208,3
110 DATA 76,98,141,201,62,208,3,76
,241,140,201,73,208,6,32,130
120 DATA 138,76,51,138,201,68,208,
3,76,168,140,201,83,208,6,32
130 DATA 60,140,108,2,3,201,77,209
,3,76,178,141,201,65,208,6
140 DATA 32,228,141,108,2,3,108,0,
3,32,107,169,32,123,0,208
150 DATA 3,76,230,140,76,168,164,3
2,135,135,163,73,160,131,32,30
160 DATA 171,32,60,140,168,0,141,1
74,2,163,152,160,131,32,30,171
170 DATA 32,36,165,134,122,132,123
,32,115,0,170,208,3,76,108,168
180 DATA 160,0,165,170,131,153,176
,2,200,201,255,208,245,32,33,130
190 DATA 165,183,201,20,144,5,162,
83,108,0,3,160,0,162,3,177
200 DATA 187,153,180,2,200,232,196
,183,144,245,142,176,2,163,160,160
210 DATA 2,133,167,132,168,202,202
,202,134,163,32,162,130,32,143,138
220 DATA 183,0,32,213,255,144,13,3
2,18,130,165,58,160,131,32,30

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Assembler Part 4

```

230 DATA 171,76,101,139,92,19,130,
32,229,139,32,99,165,108,2,9
240 DATA 169,255,160,1,145,43,32,5
1,185,166,34,24,216,109,2,139
250 DATA 45,166,35,105,0,133,46,96
,160,1,177,43,209,3,76,66
260 DATA 140,32,229,139,32,115,0,2
40,13,201,33,240,49,32,33,130
270 DATA 32,132,133,76,99,140,32,1
88,136,173,176,2,162,177,160,2
280 DATA 32,189,255,166,45,164,46,
169,43,32,216,255,144,3,76,219
290 DATA 135,32,183,255,240,3,76,2
10,136
291 REM *****
***
292 REM TO REMOVE AUTO-VALIDATE, R
EPLACE LINE 295 WITH THIS
293 REM 295 DATA 234,234,234,234,2
34
294 REM *****
***
295 DATA 169,66,32,76,135
296 REM *****
****
300 DATA 32,150,138,169,1,141,174,
2,32,19,130,76,114,137
304 REM *****
****
305 REM ** EDITOR SUBROUTINES 2
306 REM *****
****
310 DATA 169,0,169,145,43,200,146,
43,185,43,24,106,2,133,45,165,44,1
06,0,133
320 DATA 46,76,99,166,166,137,201,
64,209,3,76,49,234,201,4,209
330 DATA 243,163,138,209,246,66,32
,240,255,152,56,233,10,176,252,73
340 DATA 255,105,1,170,236,160,0,2
62,240,3,163,23,153,119,2,200
350 DATA 76,133,140,132,199,162,96
,160,255,136,200,253,202,209,240,7
6
360 DATA 49,234,32,115,0,32,21,130
,32,19,166,144,61,165,35,72
370 DATA 165,66,76,163,45,32,259,1
74,32,21,130,32,18,165,144,42
380 DATA 160,1,177,95,170,138,177,
95,169,104,133,66,104,133,99,152
390 DATA 160,0,146,95,200,138,146,
95,200,177,95,138,20,200,177,95
400 DATA 133,21,169,0,141,0,2,76,1
64,164,76,227,168,32,247,140
410 DATA 108,2,3,32,115,0,240,20,3
2,21,130,165,20,133,251,165
420 DATA 21,133,252,32,253,174,32,
21,130,76,28,141,169,10,162,0
430 DATA 133,251,133,20,134,252,13
4,21,165,43,166,44,133,253,134,254
440 DATA 160,1,177,253,208,1,32,18
,130,99,160,3,165,259,146,253
450 DATA 138,165,251,146,253,136,1
77,253,170,136,177,259,133,253,134
,254
460 DATA 165,251,24,101,20,133,251
,165,252,101,21,133,252,90,209,162
470 DATA 15,108,0,3,32,115,0,240,3
32,21,130,32,19,166,76
480 DATA 130,141,165,43,166,44,133
,55,134,66,160,1,177,95,209,6
490 DATA 32,18,130,108,2,3,160,2,1
77,95,170,200,177,95,32,209
500 DATA 169,66,32,240,255,160,10,
24,32,240,255,160,4,177,95,240
510 DATA 8,32,219,255,200,208,246,
32,18,130,169,1,177,95,170,136
520 DATA 177,95,133,95,134,99,32,2
25,255,240,187,76,110,141,32,115
530 DATA 0,32,33,130,169,1,162,8,1
60,0,32,186,253,165,45,56
540 DATA 233,2,170,165,46,233,0,16
8,169,0,24,32,213,253,176,3
550 DATA 76,216,139,108,0,3,169,64
,160,131,32,30,171,106,2,9
560 DATA 32,115,0,208,13,169,10,16
2,0,133,251,134,252,133,253,76
570 DATA 11,142,32,21,130,32,253,1
74,165,20,133,251,165,21,133,252
580 DATA 32,21,130,165,20,133,253,
163,21,162,142,141,2,3,142,3
590 DATA 3,173,0,2,240,46,165,251,
165,252,32,95,142,169,11,133
600 DATA 159,160,0,169,29,153,113,
2,200,152,11,144,246,169,0,2
610 DATA 157,119,2,209,16,247,24,1
65,251,101,253,133,251,144,2,230
620 DATA 252,76,240,138,169,240,16
2,139,141,2,3,142,3,3,108,2
630 DATA 3,134,33,133,98,162,147,5
6,32,73,169,92,223,163,32,135
640 DATA 169,32,166,162,162,0,169,
0,1,157,0,2,240,3,232,208
650 DATA 245,96
1000 FOR B=35444036460
1010 READA:POKEB,A
1020 NEXT
1030 PRINT"FINISHED"

```

01-430 0954

d = disk *r* = cartridge *c* = cartridge

d = disk; c = cassette; r = cartridge

Name _____
Visa/Access Card No. _____
Address _____
City _____ State _____ Zip _____
Country _____

Date _____ Signature _____

This month Joe Nicholson
continues our C-16 series
with an explanation of
programmable characters.

Programmable characters

IT IS POSSIBLE TO USE CUSTOM designed character sets on the C-16, even though Basic 5.5 does not have supporting commands.

To understand how this is done, one must first examine how the normal character set is stored. Data for the character shapes is stored in the ROM from address \$D000 to address \$D7FF (\$D200 to \$D29F) hold the data for character set 1 (upper case letters and graphics). Locations \$D700 to \$D7FF (\$D720 to \$D75F) hold the data for character set 2 (upper and lower case letters). Each of the two character sets takes up 1K of memory. Characters with screen codes between 128 and 255 are reserved images of codes 0 to 127 and are therefore not stored in memory.

The characters are stored in the order shown in the screen display codes in Appendix I of the C-16 User Manual. For set 1, the first character is therefore "0". This is stored in eight bytes, one byte per pixel line (eight dots) of the screen display. Each byte of the character "0" contains the eight bits needed for each row of the character, viewed in binary form (one for on, zero for off). The leftmost bit of the row is the "128" bit, the second to the left is the "64" bit and so on to the "1" bit on the far right. The "0" sign is therefore stored as shown in Figure 1.

For a character set to be created in RAM, space must first be made available in which to put the character set. Assuming the high-resolution screen will not be used in conjunction with programmable characters, the top 1K of RAM (\$5000-\$5FFF) is the most convenient. This is done by moving the "highest address used by Basic" pointer (\$5-M) and the "bottom of string storage" pointer (\$5-S) down 1K from the top of RAM (see last month's article: The Memory map and where to store machine code). Type:

```
POKE 5-M,POKE 5-S,5000-CLR
```

As "CLR" is used this should be done at the beginning of the program.

Assuming you don't want to redefine all 128 characters of the new character set, you need first to move one of the ROM

PROGRAMMING THE C16

character sets down into the 1K block. This can be done easily by entering the MONITOR and typing:

```
T 1000 D1FF 3000 — for set 1, or  
T 1000 D7FF 3000 — for set 2.
```

Then enter "X" to leave the Monitor.

To move the character set down inside a Basic program is more difficult. A FOR-NEXT loop takes over 15 seconds, so I've written a short machine code routine which does the task almost instantly. The program is completely relocatable, i.e. it will work whenever it is stored in memory. The start, end and length values may be altered as desired for different applications. Figure 1 shows an assembly listing of the routine using the C-16

Assembler published in the June edition of Your Commodore. It is positioned in a free space below Basic at \$600 hex, 1500 decimal (see last month's Where to store machine code). To execute the routine from Basic, type: SYS 1500.

To make your character set the current one, you must first disable the Shift+Commodore key with POKE 0,CH05(0), and then set the "Character data base address" pointer at \$D200 as desired. Its two to seven of this pointer are the upper six bits of the high byte of the character set address. This enables the character set to start at any multiple of 1K. We are using the default 0 (\$D000 to \$DFFF), so the number entered is 00 (11*4) decimal.

To specify that the character set will be

```
START: 10000 1SHOFT MEMORY
10010  ORG 10000
10020  ;
10030  ;START READING FROM
10040  LDA #0
10050  STA 300
10060  LDA #1000
10070  STA 301
10080  ;
10090  ;START WRITING TO
10100  LDA #0
10110  STA 302
10120  LDA #30
10130  STA 303
10140  ;
10150  ;NUMBER OF BLOCKS TO
10160  ;BE MOVED (4 FOR 1K)
10170  LDX #4
10180  ;
10190  ;PERFORM MOVE
10200  :L1 LDY #0
10210  :L2 LDA (300),Y
10220  STA (400),Y
10230  INY
10240  BNE R:L2
10250  INC 301
10260  INC 303
10270  DEY
10280  BNE R:L1
10290  RTS
>> OK.
```

Figure 1

Address	Hex	Binary	Image
hex			
\$2000	00C	00111100	0000
\$2001	00A	01100110	0000
\$2002	00A	01101110	0000
\$2003	00A	01101110	0000
\$2004	000	01100000	00
\$2005	002	01100010	00 0
\$2006	00C	00111100	0000
\$2007	000	00000000	

Figure 2 Shift memory routine



accessed from RAM) as opposed to ROM, bit two of address 60200 must be set. As it is important that the other bits at that address should remain unchanged, a line like this should be used:

```
POKE 60200,PEEK(60200) AND 255
```

to specify 'character set in RAM'. To get back to the normal ROM character set,

the following POKEs should be entered:
POKE 60200,255
POKE 60204,PEEK(60204) OR 4

Whenever an error is encountered, the ROM/RAM select bit is reset back to ROM, creating havoc on the screen if the 'Character data base address' pointer is not pointing to the ROM character set.

```
10 REM PROGRAMMABLE GRAPHICS DEMO
100 POKE50,59:POKE52,59:CLR
110 FORM=1536TO1570:READ:POKEA,B:NEXT:B
  YS1536
120 DATA189,0,139,298,189,208,133,289,18
  9,0,133,210
130 DATA189,68,133,211,162,4,168,0,177,2
  88,145,218
140 DATA289,289,249,238,289,238,211,282,
  289,240,98
150 RESTORE10000:FORA=97TO9:READ:POKE15
  300+A,B:NEXT
160 PRINTG-B1(8):POKE65299,62:POKE65299,
  PEEK(65299)AND255
170 TRAP250:GOTO1800
180 PRINTERR:ERR3,CL
190 POKE65299,288:POKE65299,PEEK(65299)
  OR4:END
1800 COLOR,1:COLOR4,1:COLOR1,0,8:SCHELC
1810 PRINT"FFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFF":
1820 FORA=1TO32:PRINT" "TAB(35)" "I:NEXT
1830 PRINT"FFFFFFFFFFFFFFFFFFFFFFFFFFFFF
  FFFFFFFFFF":
1840 COLOR1,2,8:CHAS,18,31,"SHI"
1850 COLOR1,2,4:CHAS,8,34," 8815423
  8888888"
1100 FORB=3TO12:FORA=1TO8:COLOR1,A+1,4
1110 CHAS,8,1A+3>1," 888 888 888 888
  888"
1120 CHAS,8,1A+31," CDE CDE CDE CDE
  CDE"
1130 FORC=1TO100:NEXT:NEXT:NEXT
1200 FORB=127TO3STEP-1:FORA=1TO8:COLOR1,A
  +1,4
1210 CHAS,8,1A+3>1," 888 888 888 888
  888"
1220 CHAS,8,1A+31," CDE CDE CDE CDE C
  DE"
1230 FORC=1TO100:NEXT:NEXT:NEXT
1240 GOTO1100
18800 DATA32,56,152,159,181,255,255,253
18810 DATA8,0,8,155,231,231,255,61
18820 DATA4,0,3,249,253,255,255,63
18830 DATA253,253,255,255,121,63,1,1
18840 DATA189,24,255,68,231,255,195,155
18850 DATA181,63,255,253,155,253,138,128
18860 DATA253,138,191,181,185,189,129,25
  5
18870 DATA8,0,8,3,15,31,63,355
18880 DATA24,34,128,255,255,255,255,255
18890 DATA8,0,8,192,248,248,253,253
```

Figure 3 Programmable graphics demo

This means that editing should always be done in normal (ROM) character mode.

Also, it is a good idea to put the 'get back to the normal character set' commands at the destination of a TRAP command to stop this happening (see page 141 of the User Manual). Furthermore, however, that the TRAP command must come after the CLR command used when lowering the top of RAM.

Entering programmable characters

The address of the character in RAM can be found as follows:

Address = Base address + (screen code * 8)

The eight bytes for each character can be read into memory by a simple FOR-NEXT loop, with the numbers stored in DATA statements. Figure 3 is a demonstration program to illustrate the points covered in this article. The program functions as follows:

LINE 180 shifts the top of memory down 16 for the new character set.

LINE 180POKEs into memory the machine code routine SHFT-M888 held in the DATA statements in lines 180-179. It then calls this routine. This routine shifts the ROM upper case character set down into the new RAM area.

LINE 200 ERASEs in the Programmable character data stored in lines 18000-18800 into the start of the new character set (SHI) character to be defined is '8', then 'A', then 'M' etc.

LINE 210 - PRINT CHAS888 - disables the ability to change character set with the Shift/Command key. As only one character set has been redefined, this disables the ability to change to a garbage character set.

LINE 220 turns on TRAP mode to Line 250 and jumps to the Demonstration (line 1880).

LINE 250-260 The TRAP routine.

LINE 250 prints the error and the line number on which the error occurred.

LINE 260 first changes the BASIC address to point to the ROM character set, then selects 'character set to be taken from ROM', then INVR.

LINE 1000 defines the colours and clears the screen.

LINEs 1010-1030 print the border.

LINE 1040 prints your base.

LINE 1050 prints the scores.

LINEs 1100-1130 move aliens right.

LINEs 1200-1230 move aliens right.

LINE 1240 performs this spectacular feat of imagination all over again.

LINEs 18000-18800 the programmable characters.

LINEs 10000-10050 the six programmable characters needed for the alien.

LINE 10060 the border character.

LINE 10070-10080 the base.

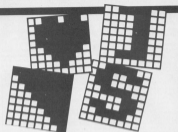


Listings will be much easier to
enter with our new system.

COMMODORE LISTINGS ARE RATHER well known for the horrible little black blobs that always abound. Unfortunately the graphics characters which are used to represent graphic and control characters do not reproduce very well and they are also difficult to find on the Commodore keyboard.

For this reason your Commodore started to provide any control characters with a B1M statement on the previous line that explained exactly what the black blobs were meant to be. Unfortunately the graphics characters were not documented and there still cause some confusion. For this reason we are starting to use a new method for marking the control and graphic characters in our listings.

In future all control and graphics commands will be replaced by mnemonic within square brackets. This mnemonic is not typed out as printed in this magazine but rather the corresponding key or keys on the keyboard are pressed. For example (RIGHT) means press the cursor right key, you do not type in (RIGHT). All of the keywords, what keys to press and how they are shown on the screen are shown below.



LISTINGS

Any character that is accessed by pressing shift and letter will be printed as (X LETTER)

(X A)
(X C)

shift and A
shift & C

Any character that is accessed by pressing the Commodore key and a letter will be printed as (X LETTER)

(X A)
(X C)

Commodore & A
Commodore & C

(X 1)

Any control key will be printed out as a number. For example (001). Control codes are accessed by pressing the CTRL and a letter at the same time (001) is CTRL & A, 002 is CTRL & B etc. See the manual for more information about control codes.

(001)
(004)

CTRL & A
CTRL & Z

Mnemonic	Symbol	what to press
(LEFT)		left/right
(LEFT)		shift left/right
(UP)		shift & up/down
(DOWN)		up/down
(H)		H
(H)		shift & H
(H)		H
(H)		shift & H

Mnemonic	Symbol	what to press
(H)		H
(H)		shift & H
(H)		H
(H)		shift & H
(H)		shift & CTRL / HOME
(H)		CTRL / HOME
(H)		CTRL & H
(H)		CTRL & H

Mnemonic	Symbol	what to press
(BLACK)		CTRL & 1
(WHITE)		CTRL & 2
(RED)		CTRL & 3
(CYAN)		CTRL & 4
(PURPLE)		CTRL & 5
(GREEN)		CTRL & 6
(BLUE)		CTRL & 7
(YELLOW)		CTRL & 8



Your

Submissions

COMMODORE

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SO YOU'VE WRITTEN SOME PROGRAMS?

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publication, it will be returned to you.

You may not have written any software yourself, but you have very firm opinions about the world of Commodore and all their attendant industries and products. Then put your opinions on paper and post them to us, again at the address below — you never know, you might even get paid for airing your views! All submissions should be sent to:

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PROGRAM COMPLETE IN BLOCK CAPITALS

Your Name _____

Program Name _____

Computer/memory size it runs on _____

Amount of memory program occupies _____

Other computer/memory size which your program runs on without conversion or use _____

Does your game need or use joystick? Yes No

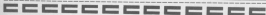
Have you sent your game to another magazine? Yes No

Is it original or a variation on a theme? _____

Your Address _____

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1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

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VIZASTAR 64

(continued from page 10)

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Value

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Nick Hampshire.

FULL SPEED AHEAD

THE MOST THOROUGH AND insistent operation on the C64 is using the cassette deck to LOAD or SAVE a program. The operating system tape routines function OK but are so cumbersome and slow that the thought of loading a disk drive soon becomes a matter of very high priority in every user's mind. However, while waiting for your disk drive, all is not lost. With a single piece of software, it is possible to speed up the tape routines to give a loading speed equal to that of a disk drive.

Virtually all C64 software currently being marketed uses some form of fast loader. These fast loaders are given names like Turbo-Plus (the first fast loader available), Fastload, Flash Load, etc. The origin of these fast loader routines is rather obscure since many of the software houses use the same loader routines. In this article we give the source code for two fast loaders and their associated SAVE routines. These have been used on several software products of Zilla Software Ltd, under the name of ZFTLoad and ZFTSave.

A fast loader is a routine which replaces the existing LOAD and allows a program or data to be loaded from tape at about 10 times normal speed thus making a tape as fast as a disk drive. A fast loader simply changes the format of the pulse sequence stored onto the tape in order to allow a far greater density of information storage per inch.

In order to create a fast loader two programs are needed. Firstly, a fast loader program, which is a fairly short machine code routine loaded at the beginning of a LOAD operation and auto-run to LOAD the rest of the program and/or data stored in fast loader format. The second program is a routine to SAVE a program in fast loader format, the fast SAVE.

The first major design problem to be overcome is the storage of each bit on the tape, each bit is stored as a pulse which goes through a high-low transition (see figure 1). The length of the total pulse decides whether the bit is a one - A long pulse - or a zero - a short pulse. The bit is flagged by the interrupt register on the falling edge of the pulse.

The loader is a machine code program which runs with the interrupts disabled. It sets a timer between the two lengths, and when the timer runs out the interrupt register is checked to see if the pulse came in or not. If the falling edge of the pulse generates an interrupt before the timer runs out then the pulse was a zero, otherwise it was a one. The bits are then stored into a byte storage until eight bits have been read, thereby loading a full byte.

Before any bytes can be read and stored, the loader must be in sync with the bits on the tape. A string of zero bits with a single one bit at every byte interval achieves this. The routine then tries to align itself by recognising the value of the byte.

An example of a loader byte for alignment would be the value 65, hex 80 or, in binary, 01000001. A series of these bytes is written in the header. Only when this byte has been read in and recognised can the actual program be read without risk of alignment error.

The program is stored in different ways depending on how much is desired. The simplest way of formatting the file is to first SAVE the two byte load address followed by the two byte end address and then the actual file. The final byte following the end of the file is a checksum calculated by the save routine and also during loading. If the two values are the same, the LOAD was successful. The routine for this

form of fast loader is given in Program one.

Another type of LOAD, which uses the same save but is slower, is the interrupt loader. This method has the advantage of LOADING with the screen-on and a foreground program running while the main program is loaded. Loaders of this type are Novoload and Microload. The difference is that an interrupt is created when a pulse is read by the tape recorder, and the timer is checked to find out whether the pulse was a zero or a one. The disadvantage is that in the background allowing a foreground program to play music, run a clock, etc. The foreground program must check at regular intervals to see if the loader has flagged for the end of load. The background LOAD in Program two has only a foreground program which is waiting for the end of LOAD flag to be set.

Fast Tape Routines — Making Them Work

Putting the theory into practice to create the fast loader routines is not difficult, the actual timing for the SAVE routine was not calculated from any theoretical formula but just by trial and error. The only guidelines were that the short pulses should be slightly shorter than half the long pulse, as the waveform of the pulse is skewed out by the cassette hardware, the timing value used by the loader is just shorter than the time required before the long pulse reaches its falling edge.

There are two program listings for the C64 in this article, one for each of the two types of LOAD. Each program will SAVE a basic program in its fast format and automatically put the fast loader routine into the filename where it is stored. When loaded, it will automatically start on the warm

start vector. The routines are initialised by SYS\$INIT\$. A basic program can be fast-loaded by using the SAVE command as normal but with a device number of seven, that is:

SAVE "PROGRAM".7

In addition the first fast LOAD also makes use of the secondary address to auto-run the program, that is:

SAVE "PROGRAM".7,1

will cause the program to auto-run when loaded back. With both routines, when a program has been saved using one of these fast loader SAVE routines it is unnecessary to LOAD anything before the program; it will LOAD directly from the LOAD command.

An example of how fast these routines can be is shown by the following timing table. This was based on the time taken to LOAD a 25.6K byte Basic program.

Method 1	: 1 minute
Disk	: 1 minute 18 seconds
Method 2	: 1 minute 25 seconds
Normal tape	: 8 minutes 40 seconds

It should also be noted that the SAVE routines for the fast tape operation are considerably shorter than the normal tape routines. One wonders why Commodore has not included these types of fast tape routines in the new machines.

By loading these into your C64 you will be able to take some of the medium and frustration out of using a tape system. In addition it will also make your programs look far more professional.

This article is extracted from one of the 14 Revealed series of books by Nick Hampshire and published by Collins.

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TOP DRAW

GREETINGS FELLOW 64 OWNERS, HERE are some more graphics schemes to add that bit of power to your efforts. First, however, it's graveling time. Remember part one of this series? You may have noticed a POKE to location 5000 in the demonstration. Much to my embarrassment, I didn't tell you what it does. It holds the number of pixels overlaid when you roll the roll routines. A value of one will roll the design one pixel, a value of two rolls it two pixels, etc. Values greater than three aren't too helpful, but the use of this register will make your efforts that little bit more interesting.

This month I want to deal with graphics windows. A window is a definable area of the screen which can be manipulated independently of the rest of the screen. The real value of windows is in the generation of menus and text games such as adventures.

As usual, the software is given as a basic loader in listing one. The code is at \$C000 so it will unfortunately clash with the character routines - object apologies but such is life.

The first problem to resolve is how to define a window. Consider Figure 1. The rectangle represents a window of width W characters and height H units somewhere on the screen. The top left hand corner is fixed by the co-ordinates XC and YC. These four values are all that is necessary to specify the window. The machine code allows you to increase and access up to 16 windows - numbered 0 to 15. Each window is defined in four tables in terms of co-ordinates of the top left hand corner and the height and width. The command for specifying a window has the syntax:

```
WYS #WHL,WL,XC,YC,W,H
```

W is the window number and the other parameters are as specified earlier. It is important that you set up a window before manipulating it. When the program is set up the window tables contain zero and any action on an on-defined window will, at best, corrupt your Basic program so be warned!!

What can you do with the window? The next command has two forms depending on what you wish to do. A flag denotes your action and the syntax. The first form will fill the window with a specified character CH:

```
WYS #WHL,WL,CH
```



i.e. the flag has a zero value. A non-zero flag simply reverses the contents of the window:

```
WYS #WHL,WL
```

If you use the fill command with a value of CH equal to 32, the window will be cleared.

Finally, you can scroll the contents of the screen. To maintain compatibility with the normal 64 operation, the scrolling is upwards with the bottom line of the window being filled with blanks. The syntax of this command is:

```
WYS #WHL,WL
```

To help you see what these routines will do, I've given two demonstrations. The first shows the manipulation of three windows at once. Since the window scrolls upwards, you read something print text at the bottom line. In my experience, the use of cursor-control codes and TAB are both elegant and tiresome. It's far better to use a routine in the 64's Kernel. The following line will do this:

```
POKE 761,Y: POKE 761,X: POKE 761,X: WYS #WHL
```

where X and Y are the co-ordinates of the point to which you want to move the cursor. Line 760 in the demo does this.

The second demonstration uses randomly created windows to produce a pattern.

I have included a degree of checking in the routine so that some illegal values (e.g. width 40 or height 25) will be

rejected. Not all possibilities are catered for and it's up to you to ensure that silly values are not generated in your program.

The routines should be of most value to adventure freaks since it is simple to create two or three text windows with independent scrolling.

Now, I want to deal with a feature which the BBC, C/M and Spectrum have in common. The ability to use flashing characters. The simple way to implement this is to use the attribute of each character to hold a flash flag. This is not simple to do on the 64 because there is no spare bit in the video matrix and it isn't easy to use the top four bits in the colour matrix. My solution is to let you select a colour to flash. This colour is kept in location 5000. The routine is called every 10th of a second by the IRQ interrupt. The screen is scanned every 25 interrupt calls, so that the flash rate is about twice a second. The routine scans the colour matrix and inserts every character of the specified colour. This routine is given in Listing two and a demonstration is demo three.

Owners with new 800M 64s should take a little care. These machines fill the colour matrix with the current colour each time the screen is cleared. If the current colour is the flash colour, the whole screen will flash. Demo three shows how to use the routine.

To turn off the character flash, simply enter:

```
WYS #2736
```

That's all for this time, see you again next month. Happy hacking!

Demonstration 1

```

0 REM DEMONSTRATION 1
1 REM
10 POKE55550,1
20 OS="-----"
30 DATA 0,0,0,10
40 DATA 15,0,0,12
50 DATA 5,3,10,10
60 FOR WN=0TO2: READ X(WN),Y(WN),W
   I(WN),H(WN)
70 NEXT
80 FOR WN=0TO2
90 SYS 12*4096+3,WN,X(WN),Y(WN),W
   I(WN),H(WN)
100 NEXT
110 FOR WN=0TO2
120 CO=ROUND(1*16:IFCO=1THEN120
130 POKE55,CO
140 IFWN=0ORWN=1 THEN GOSUB 150:FR
   I(LEFT$(OS,WI(WN)):S=12*4096,WN
   150 IFWN=2THENSYS12*4096+6,WN,0,W
   I(1)*256
160 IF S=0(1)*4,5THEN SYS 12*4096+6
   ,WN,1
170 NEXT
180 GOTO 110
190 POKE781,Y(WN)+H(WN)-1:POKE78
   2,X(WN):POKE783,0:SYS55550:RETURN

```

Listing 1

```

0 REM LISTING 1
1 DATA78,3,155,78,119,199,76,133,1
   53,32,239,199,165,20,141,232,3,32,
   810,192
2 DATA32,25,199,24,165,163,105,40,
   133,187,165,164,105,0,133,188,24,1
   66,168
3 DATA105,40,133,178,165,170,105,0,
   133,177,179,32,133,170,33,199,136
   ,177,187
4 DATA165,163,177,178,145,189,136,
   16,245,202,240,29,24,165,163,105,4
   0,133
5 DATA183,144,2,230,164,24,103,187,
   106,40,133,167,179,2,230,169,32,6,
   133,76
6 DATA52,199,179,31,133,136,169,32,
   145,163,163,1,145,165,139,16,245,
   96,32
7 DATA99,132,165,25,201,10,178,64,
   141,232,3,32,239,199,179,232,3,16
   5,20,201
8 DATA41,178,45,133,33,199,32,239,
   132,172,232,3,165,20,25,178,39,
   133,169
9 DATA133,32,239,166,178,232,3,165,
   20,201,41,178,18,163,113,153,32,2
   39,152

```

Demonstration 2

```

0 REM DEMONSTRATION 2
1 REM
10 XS=INT(RND(1)*20)+1
20 YI=INT(RND(1)*20)+1
30 YS=INT(RND(1)*12)+1
40 H1=INT(RND(1)*12)+1
50 SYS12*4096+3,1,XS,YI,WI
60 SYS12*4096+6,1,0,RND(1)*128
70 SYS12*4096+6,1,1,GOTO10

```

Listing 2

```

0 REM LISTING 2
1 DATA155,25,145,233,3,120,169,79,
   141,20,3,169,206,141,21,3,88,56,16
   8,0,133
2 DATA251,169,216,139,252,160,0,17
   7,251,45,15,205,232,9,206,17,165,2
   51,133
3 DATA253,55,165,252,233,212,133,2
   54,177,253,73,128,145,253,230,251,
   206,2
4 DATA230,252,165,251,201,232,240,
   3,78,29,206,165,252,201,219,240,3,
   76,28
5 DATA206,55,206,233,3,206,8,169,2
   5,141,233,3,32,18,206,76,45,234,23
   8
6 FORI=527351055551
7 READX,T=T+X
8 POKE 1,X:NEXT
9 IF T<>13730THENPRINT"ERROR IN DAT
   A"
10 REM
11 REM FLASHING CHARACTERS ROUTINE

```

Demonstration 3

```

10 REM DEMONSTRATION 3
20 REM
30 SYS 52736: REM TURN THEM ON
40 POKE 1000,1: REM WRITE TO FLASH
50 PRINT"COLLARDICYAN"THIS CUNITED
   151YELLOW4 CUNITEDDEMONSTRATIONC
   75 OF CWR
   1123FLASHINGC6 80 CHARACTERS"

```

```

00 DATA178,238,3,188,20,203,25,178
01 7,133,123,123,95,155,155,155,155,
34,90
11 DATA171,35,73,75,75,55,71,55,75
35,55,55,75,55,55,53,0,172,232,3,
155,53
12 DATA133,141,83,153,155,153,153,
141,50,123,123,133,123,141,51,123,
125,123
13 DATA133,141,52,123,55,32,253,57
4,32,139,573,32,277,123,55,125,125
24,125
14 DATA45,133,178,155,178,125,0,13
3,177,55,24,125,123,125,40,133,123
124,0
15 DATA230,170,24,155,175,125,40,1
23,178,144,2,230,177,55,155,0,133,
123,155
16 DATA94,133,154,174,30,123,240,55
24,155,123,125,40,133,123,125,124
125,0
17 DATA133,184,202,205,240,174,55,
123,240,14,24,155,123,125,55,1
23,123
18 DATA155,124,125,0,133,244,155,1
53,133,125,155,154,24,125,232,133,
170,55
19 DATA10,2,10,10,0,0,0,0,0,0,0,0,

```

[illegible]

FAST LOADERS TO DISK

COMMODORE 64
64K BYTE DISK

Tape East Loaders

Abstract

[illegible][illegible]

1. **ATrans (TAP)** files Transfer Loader. Add this program to each of your disks and your programs will load at their TAP files (some use the normal old .NO name) required and you DON'T have to load additional programs. Exchange this transfer format upon the network with the **ATransLOAD** file in 30 seconds.
2. **FAST Copy** is high speed single step which does a copy of a transfer file to a hard disk. I recommend it handles many compressed disks but not if transfer problems.
3. It multi copies **FAST** file format and a single file transfer routine which will handle programs file-of any length.
4. **Index To FAST**. Transfer any single file programs to tape (fast load). No memory conflict will transfer.

17-00000-1, 17-00000-2, 17-00000-3

The Premier does not transfer ability for your new lead representative. Multiple, overlapping, and/or non-approved are all covered by his own knowledge applied. Please: 1. Use previous for program type, which is often either one. Based on this.

[illegible]

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10. Designing the flexibility within the programme: programme managers must ensure that the programme is flexible enough to respond to changes in the environment. This may involve designing the programme to be able to adapt to changes in the environment, or it may involve designing the programme to be able to respond to changes in the environment.

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All programs for the Commission till
 31st July for full details or changes? (i) for full
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[illegible]

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"Darling, it's been on that phone all day"



"Darling, it's been on that phone all day"

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Peter Thomas has been

exercising his brain on

Ocean's Summer Games II.

His verdict was very good.

Read on.

FOR THOSE OF YOU, LIKE ME, WHO think that physical exercise is moving the car an extra yard or so from the front door each morning but who are mentally capable of giving Daley Thompson and Steve Cram a run for their money, Summer Games II is just perfect.

Owners of the original Summer Games - now world leaders in the pole vault, club hands at the full back slide, champions in the 8+400 metres relay and challenging Carl Lewis's 100 metre record - beware! If you have thrown in the towel in the freestyle relay and consider the gymnastics and shoot doubling difficult to master, rest assured that you can sit back and relax with Summer Games II - because it's twice as difficult.

You start with a simple hop, step and jump in the triple jump and if you don't fall head first in the sand you can watch an entire replay of your successful soar across the sand while the appreciative crowd applauds.

Quartermen and women among you can tackle the single sculls rowing and pit your skill against your rivals, the computer or the clock. The split screen makes this event very exciting and realistic.

After the water you return to dry land for the javelin where a combination of speed, timing and power sees the javelin fly through the air across the screen. Again a good three gain appreciation from the crowd.

The equestrian event brought back memories of pony trekking on Dartmoor when again I seemed to spend more time on the ground than on the horse. Timing is essential if you don't want an early ducking in the water jump.

Once you've had enough of horning around you can attempt the high jump. I'm not sure whether there was a bug in my version of the game or whether I'm just not cut out for the high jump, but I only managed to get over the bar once and that was on the lowest level.

If you've got a grudge against someone then you'll love the fencing. Now you've got your chance to flex your foil and battle it out with your opponent. Control is a little difficult but after some practice, and a few beatings, you'll get used to it.

If you find that you have trouble staying on a tricycle then the cycling event is certainly not one for you. Rotating your joystick moves the man's legs on the

pedals. If you don't move your joystick at a steady pace then you'll find yourself getting nowhere and see your opponent disappear towards the finishing line.

Kayaking is certainly not an event to be rushed. You must guide your kayak down the white water while passing through a number of gates. Some gates must be passed through forward, others backwards, while you even have to guide your kayak through while going upstream. This is certainly an event which takes a lot of concentration. You'll soon figure out how to guide your craft but

getting through the gates is a different matter.

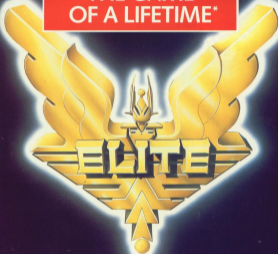
In each event you strive for gold silver or bronze medals all the time attempting new heights of glory to become the world record holder.

Choose which country to represent out of a possible 16, put on your sportsman and prepare for Summer Games II. Alternatively, lock your bedroom door switch on your computer and practice each event for half an hour while going on a strict diet until you are ready for the next major championship.

P.T.



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Runecaster risks life and limb
yet again in order to bring
you his column.

AS I AM SURE YOU ALREADY KNOW, adventure games can cost quite a lot of money! Generally speaking the more expensive games are also loved and provide you with many hours of pleasure for your money. The higher middle range of tapes (around £10 plus) seem to be the ones that sometimes make you think.

On the other hand there are a number of bargains around. My local Spectrum Chain shop had a couple of good buys... One would be loosely (very loosely) classed as an arcade adventure - *Mystic Mansion* - and the other, a well presented text adventure, was *Allard's Tomb*. Respectively, £7.99 and £5.99.

The first, *US Gold*, hardly comes within the range of this column but is worth looking at, especially if you have young children around. It is a 2D level, find the treasure, avoid the monsters, type of game with a good difficulty grading - Adults, Teenager or Child.

The second, *Allard's Tomb*, is a real life adventure that does not appear to have any obvious inconsistencies and at the price it well worth buying. Fairly conventional scenario...dark dungeons, in which you have to find the shrouded Tomb, solving several ingenious puzzles in the process.

Keep your eyes skinned for these and other 'cheaper', they are often either newbies or are rock from distant software houses. You will not find *Foodies*, *Utopia*, *The Hobbit* or *Jackie* but may well find something to keep you interested.



Kitchen spin-off...

Down in the kitchen something stirred...or rather squeaked! It was probably the lady of the house using one of those reusable shopping list boards - you know the type: plastic-based and supplied with a water soluble ink marker. Hidden notes throughout the week on what is required - buy them on Saturday and wipe the 'dirt' clean on Sunday.

What has this to do with playing adventures? Well, a firm in Wales, Mapt, has produced a plastic reusable Map Maker. It is A4 size (two pages of *Tome Commodore*) and has a 10x11 grid of 1402mm rectangles printed on it...just the thing for mapping all your trips abroad! There is space at the top of the board to make 'vital notes' and the pens supplied have a fine enough point to enable all the vital facts of a location to be recorded in the space provided.

The Magic Maker costs £14.99 and there also is a range of suitable pens in various colours at 99p each. A little more expensive than notepaper but as an approach Christmas, Magic can be found at 166 Bakers Street, Trowdale (perhaps we should have a check-out on that). Mid Glamorgan CF10 3JA.

Red Moon



Level 9 Computing

Over the moon

Level Nine does it again. Red Moon is the latest from Britain's number one adventure software house. As usual the pictures are available for a number of computers but of interest to us here is the C64 version.

Over 300 pictures can be found as you explore the 'mug' land of the Red Moon. Level Nine seems to improve with age, not only can you turn the pictures off, using the 'dissolve' time, but with this program you can even type in commands while the pictures are being created on the screen.

The Red Moon is about a land where Magic works, albeit nowhere nearly as strongly as in the past. In the past the moon was crimson red and the source of all the great Magic. As the moon faded to the grey we know today, so the Magic waned. A great concourse of Magicians created a substitute - the Red Moon Crystal. This was mounted in the Moon Tower of Baskalos and shone out over the kingdom, maintaining an island of Magic and enlightened Civilization.

But... the great Crystal was stolen. The Red Moon is the story of how a Magician [you!] recovered this fabulous gem and restored Magic to the World.

Not only are there hundreds of some writing pictures but there are also the long and descriptive texts that have always been the hallmark of Level Nine games. Read, and wonder at it all... how do they get it all into our computer's memory! The pictures are good, better than the other surrealistic landscapes of Return to Eldor. They are certainly not high, 16-colour works of art but serve the very important purpose of visually triggering recognition of your present location.

As with all Level Nine games (and most other good adventures) it is important to keep a careful map of your progress. There is a temptation when recognisable pictures are displayed, to skip the mapping procedures... might this temptation - dare a map!

Unlike many games where an apparently impenetrable puzzle bars your progress within a few steps of your entry point, Red Moon has plenty of locations for even the absolute novice to explore right from the start. Do not think that this implies a beginners game, even accomplished adventurers will be grinding their teeth on occasions, for those that get totally lost and confused. Level Nine offers the best hint system in the business. There are so laid out that it is not easy to read something you wish you hadn't.

Artistic freedom soon after entry will include the inevitable jump for subsequent exploration in dark and dangerous places. Dangerous! Not! There are a number of decidedly aggressive creatures just waiting for you to stumble by. To be successful you will have to fight them. Bare hands are not to be recommended, find a useful weapon and better still some armour to protect you. You start your trip into this other world with some 'hit points', it is surprising how quickly these can be used up. The use of Magic is permitted, even encouraged. To implement these spells you must enter a command of the type 'CAST ZAP'. Each spell may only be cast successfully if you have the object that is the 'focus' for that particular spell.

'CAST ZAP' is used to magically attack an enemy but you must have the jewelled dagger for it to work. Casting spells also uses up some of your 'hit points', so try not to be too extravagant with them.

SAVE and RESTORE your current position are also counted as spells! In this case no 'focus' is required but it will use up your 'hit points'. Achieve dodginess, as it helps in making dozens of 'safety saves'.

Whether can you cast a spell successfully if you have less about your person (at that location). You cannot fault the logic, even if it is a little frustrating at times!

The C64 tape version utilizes a 'rapid loader' and takes just less than three minutes to load this monster program. So, even though the screens are usually available the game is fairly snail.

Level Nine is to be congratulated on keeping standards at such a high level for such an extended time... good luck and roll on the next one - but please give me a little time to solve this one first!

Score fingers...

Although the range of good software grows as time goes by, there are always some people who like to 'do their own thing'. Obviously if you get that good at it we will start reading about your work in this column!

Many others spend enjoyable hours pondering their keyboard's typing in programs gleaned from magazines or books. This can often be very, very good programming practice. This is the way to learn how a program works (often the hard but permanent way - by having to debug it!).

It is also often possible to see how to improve on the published listing. The original programmer was probably heavily involved in his program, whereas you will be looking at each section in a fresh light.

There are already several books on the market that will help you write adventure games on the Commodore 64. On the other hand, new ones are always welcome, you never know what new routines you may find! Book is nowadays as rarely cheap but in terms of time spent at your computer are probably much cheaper than the average price of software. Two offerings have come out



was recently, one American and one British.

The first is *Golden Flutes & Great Escapes* by Deluxe 1 Home, published by Delphinum Press, ISBN 0-88098-050-7. There are only 128. Four complete listings are given together with hints, tips, flow charts and possible variations to the game play.

The book is written in clear English (American) and presents the writing of adventure games in a modular form that should be understood by the reader. The listings are in BASIC and are for text-only displays. Although I have not tested any of them in, they look reasonably interesting if you are just starting out along this path. They should give you plenty to think about. Delphinum Press Publications are distributed in the United Kingdom by: Hob Saunders Ltd., 5, St Anne's Road, Eastbourne BN21 3LN. Hob Saunders has a number of titles dealing with computers and computing, five of these are obtainable from the above address.

The second book is *Golden and Kingdoms* by Bob Litch, published by Virgin Books, ISBN 0-86369-094-7 - 126 pages cost £3.99. This book is quite different to the one above as no explanation of each individual program is given.

Listings for 15 (1) different adventures are given together with a page (128) shown or so to set the scene for each. Again the programs are in BASIC and are clearly set out for you to type in. The games are presented for you to play rather than learn from but the inevitable debugging is bound to reach you something.

Both books appear to offer good value for money - look out for them and let us know how you get on! Both publications offer copies of the games on cassette for the late amongst us!



Not for the gentle...

Do you remember *Dallas* by US Gold? It appeared in this country last year and was acclaimed by many reviewers at the time. If you have not played it, try to get your computer shop to demonstrate it for you. It is disc based only and has excellent graphics that are called from the disc as you proceed.

What made me think of *Dallas* is a recent issue from *Activision* - *Mindshadow*. It too is disc based and also has good graphics, again called from the disc. The plot is novel too, you make on a desert island... not knowing who you are!

The aim of the game is to discover your own identity and what led you to perish... As the story unfolds, you find yourself travelling around the world in search of the answers. The program is well conceived and presented, the puzzles are good and the use of the function keys will thought out.

The only thing I have against *Mindshadow* is the underlying need to behave in a somewhat underhand manner to succeed! As a barbarian clambering trails or a thief sneaking deftly through dungeons - I have no qualms... but striding out with no provocation or stealing from a sleeping tramp... I chafe. That goes apart this is a good adventure and the use of the function keys make it very easy to play. The most used commands are immediately at your fingertips. SAVE, LOAD, REPEAT, HELP,

DROP, GET, QUICKSAVE and QUICKLOAD are all function key commands.

SAVE and LOAD allow you the option of 10 different game positions. These may be convenient at any time you change your mind throughout the game. QUICKSAVE and QUICKLOAD are particularly nice features as they allow you to save your present position 'temporarily' at any time you think your next move may be your last!

HELP echoes the assistance of a wise old bird - the Condor - why a Condor I do not know but he can be damn useful! His help can only be given three times... so make use of his knowledge carefully. You can of course start from scratch and use the help gained in previous games to reach your last position, then get three new HELPs!

Although there are some obvious parts to *Mindshadow*, it is not a very difficult game to play. The number of locations in each section is not large and although mapping should always be an adventurer's first line of attack it is not always necessary here. You must solve each section before you can proceed, so at least you know how you are doing! If you are unable to go anywhere else there you know you have missed something!

But all that, I still do not know what I am, there are no prizes to anyone making any unkind suggestions!



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This game, originally on the 48 has now been converted to the 16, in effect, the game is 3D Pac-man and you are actually standing in the maze. The scenario is as before. You must collect

all the listed items on the face of the main contract providing the structure of the contracting.

Those brown creatures paint the maze and will march you given half a chance. There are a number of red dots which empower you, for a limited time, to punch the glassers. During this period, the glassers are coloured yellow rather than their usual brown. Clear all the dots and you move onto another maze.

The screen shows a perspective view of the maze walls and side passages. A comparison of block patterns and associated shading helps the effort. The goopercs are quite simple in design but grow rapidly in size as you approach them. In all a surprisingly neat bit of programming.

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surroundings on a small map which appears at the top of the screen. This shows the position of data and groovers. If a groover starts to approach you, a warning sound is given. The keyboard or joystick is used to move about the maze. You can move at quite a speed but this isn't always advisable since you can easily turn a corner straight into the arms of a groover.

In this world of more sophisticated software, it's nice to play a simple but addictive game. I found Pacman rather enjoyable since the whole action is visible. In this game, you have no idea where the ghosts are. This engenders a surprising amount of excitement. I found this game great but to play and quite addictive. The graphics are simple but most attractive. At the price, quite good value for money. **M**

11

WFF

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1000

As is the Sky Fox might suggest it is about a jet lighter but it's not one of the light aircraft that have become popular lately, more of an air postal situation. That the pilot doesn't have to concern himself with all the intricacies of take off and landing but can concentrate on the important business of receiving mail.

This brings us into the game itself. The story goes that the facilities have been invaded, either from another country or another planet, and are about the usual invasion-like things such as killing and destroying. Your job is, of course, to repel the invaders and save the world/country. In order to achieve this, you are equipped with the Sky Fox fighter plane, a weapon capable of standing still in the air or staying atop a series of 5000-ft-tall Sky Fox towers. It has a full complement of battle armor ranging from general-purpose laser guns to the air-to-air heat-seeking missiles.

The screen displays a night view that has three large windows and a radar display which shows either an all round proximity scan or a sort of weapons terrain complete with gun sights. Area available is a direct link to the main battle computer at your base, when activated this brings out an expanding window to cover the whole display. This computer link supplies information about the progress of the war with the status of various installations being displayed so that you can judge where you are most urgently required.

Keep in the data banks is a battle plan displaying the position and number of your foes as well as the locations of your base and the other settlements. This plan may be used to navigate but



using the auto pilot is much more fun as it will either take you to a specific location or it will find the nearest available bed and room there at midnight.

After being great fun and very impressive, this tactic also has a few drawbacks. It is very noisy and thus usually engages you with the enemy from the worst possible position. Consider taking two forms. First is the ground force consisting of groups of five tanks. These spread on the flanks as if you little blobs on the horizon. In this stage the blobs may be made up of with the latest very slow, the blobs be a stable totemic. As the blobs grow into very detailed battle tanks that shoot at you as you approach and to make this would spoil the fun. So my advice on the tanks would be deriving all but one, by over the top of the excellent gasoline and the rest and blow it to hell.

The entire form of control is in the air, as you climb from ground level you pass into the cloud layer and the screen goes black. At this point the data is being received but I think the cloud deck is a nice cover for this. Once through you are presented with a view of clouds and are in the domain of the enemy air fighters. These usually don't appear at all because the auto pilot sends you in the fight with the nearest threat and you, if you do manage to get one in front of you don't forget to be attacked by the smooth animation of such a large and detailed shape before you forget the Pearl Harbor and Despatch in the same form that the tanks suffered. This aside, I should state that the air control is not very at all and with an auto pilot to aid the harm of

[illegible]

The game has a large range of options made as difficulty levels from Novice to Ace and the stage and position levels involving only an in early ground content. Also, selectable is the scale of the hardest attack and the form of your task. There have been such as covered The Adams and, my personal favourite, Massimo Castaldi.

BEACH-HEAD II

US Gold £9.95

.....









CH4 - 1 or 2 joystick

This sequel to the successful Beach-head is not just one game, but four games in one. For solo or two players.

The evil Dragon known as the Dragon has captured some of your men and is holding their hostages in his heavily fortified island home. The task of the allied forces is to storm the island,

rescue the prisoners and escape with them by helicopter. You then do battle in single combat with the Dragon himself.

These four screens may be played in any order, with three skill levels for each. You may choose to play the allied troops or the dictator's forces, so many permutations are available.

The attack phase involves leading your troops by parachute from a helicopter, then advancing them individually past two barriers under withering machine gun fire. You will lose many of your men, and will need to sacrifice some for the safety of others. Bonus profits are scored for successful grenade attacks on the machine gun position.

To rescue the hostages you use a captured machine gun against a pyrotechnic array of forces, all intent on killing them. This is not easy, as the tanks and armoured trucks need to be

hit in exactly the right spot to knock them out.

In the escape stage you fly the helicopter, loaded with escapees, past a series of obstacles while under constant fire. You can strike back, and you score points for targets destroyed as well as soldiers rescued. The Dragon sets the difficulty level for each of the three games, and the highest level is really hard.

Finally, having tracked the Dragon to his lair, you engage him in battle with wooden spears called Pterosas, from opposite banks of an underground river. You move, duck and jump, and can control the spears in flight, making them invisible. Four hits win a round, nine of which must be played in all.

A marvellous game - challenging throughout, with excellent graphics and the best software speech I've heard. It deserves to be a great success!

P.B.B.

PAINTBOX

Audiogenic

.....







C-18 - joystick optional

For those who like graphics without mathematics, Paintbox is a must for Commodore users; it may open up one side of the tape to for the CH4 and the other for the C-18.

Loading is fast and efficient and the main display scrolls smoothly along the bottom of the screen. All key-point menus are instantly accessible by pressing the spacebar. The menu controls a variety of options including saving to tape or disk and a full reset.

Now what does the program offer? DRAWING is, of course, a standard feature using joystick or keyboard. To this is added:

Line - Allows a line to be drawn at any angle.

Lines - draws a series of lines starting from where the last one finished.

Paths - gives a series of lines starting from the same point.

Framing - provides a rectangle of any given size at any position on the screen.

Active BOX gives a series of rectangles of any chosen colour. GPCUR is at any place, any size and will draw to give a colour filled circle.

This sounds pretty much the same as usual but, believe me, the use of 'rubber-banding' (stretching) and zooming makes the use of the program very versatile.

When we want to move the full screen of graphics to right hand screen (DRAWING) in 'main menu' we can move the graphics to right hand screen and make the line to any point which are really excellent. Drawing speed may also be controlled.

For the CH4 alone there are extra

facilities allowing you to copy, SWAP and MOVE two pictures around building one upon the other.

Audiogenic has produced here a very good, fast acting, easily handled tool which can be used to create very intricate drawings, picture drawings, poster drawings etc.

Paintbox compares most favourably

with other graphics utilities and, indeed, would be the one of my choice by virtue of its speed, scope, ease of handling and well written manual; screen colour control is likewise excellent.

A joystick is preferable but keyboard control is fully functional and adequate.

Use it! A beginner and advanced artist. Well recommended.

P.B.B.



► ACTION REPLAY



SPEED KING

Digital Integration (\$3.95)



CM — joystick optional

If you have Quicks with cool hands and an iron nerve, then this is a game you must try! You can experience the thrill of high-performance motor-cycle racing at any of the world's top 18 circuits.

from Roundabout to Daytona, at speeds of up to 250 miles per hour. And all this from the comfort of your own armchair!

Each of the circuits is faithfully reproduced, with good graphical representation of the scenery, the track and, of course, the bikes. You race against 19 other riders, starting at the back of the grid. If you collide with another bike you crash, but can get off again. Wandering off the roadway slows you down too, and eventually makes you lose control.

Your machine is equipped with six gears, which you can change up and down, and the usual effects accompanying gear-changes are most realistic. Holding down the fire button for space bar causes constant acceleration. Releasing it slows you

down, but for heavy braking you will need to change down.

Various options are open to you. In addition to the choice of circuit, you may select novice, pro or champion skill levels, and you are given a preview of the chosen track. You may also do as many practice laps as you wish, before setting off under race conditions. The length of the race may be two, four or six laps. The computer records the total time for the race, and your fastest lap time.

I was impressed with everything about this game. It is very well programmed, fast and exciting. There is plenty of scope for improving your skill by practising, and plenty of variety. It sets a standard for motor-cycling games which will be difficult to beat. So put on your crash-helmet and get started! **P.A.B.**

RACING DESTRUCTION SET

Atari (\$14.95)

CM

Have you ever had the urge to get in a powerful car and race round a track as quickly as possible? Destruction Set will allow you to indulge all your fantasies and more!

The game consists of two race cars on the same track. Each car's progress is displayed on a separate window on the screen so if one driver gets ahead of the opponent he doesn't disappear off the screen. The cars are rather like slot cars as they will turn corners on their own and the only control required is to change slots and accelerate.

So what is the Construction in this one for? Well this is because RDS allows the user to either choose one of about 20 pre-formatted race tracks or even

to make one up himself. This allows all sorts of differing terrains and thus the game can change from a Formula One at Silverstone to a dirt track rally on the moon!

To enable the cars to race on the different surfaces the user can also control the design and specification of his car. This allows such things as a Cooper being up with an 8.2 litre engine right down to a 990cc Bika.

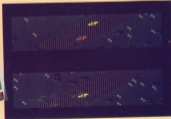
Care has to be taken when choosing a vehicle as it is very easy to construct a car that is too heavy to get up the steep hills or not powerful enough to get off the top. It is great fun however to pit two entirely different cars against each other on a variable track and see one catch up on the straight due to its power but

then fall behind on the hills due to its weight.

What about the destruction bit, I hear you ask? Well this is great fun as well because the game offers options to carry oil for throwing in the path of your opponent and land mines to blow him up! The problem with both the oil and the mines is that they stay where they are and stay ready as well so if you drop a land mine in a place where your opponent can't miss it he will blow up, but on the next lap if you can't get past it, so will you!

Although the game does a lot of very slow disk accessing, I think that it's excellent and I recommend it.

J.G.B.



KARTUS Supersoft 04.00

2 7 5 7



C16Plus 4 — joystick optional

This is another CM conversion from Supersoft. From memory, I don't think have been many alterations from the original.

The plot is somewhat unusual in that you must protect a cactus from the unfriendly attentions of a swarm of

wasps and harnets. Your efforts are hindered by interfering moles and vultures, in effect this is a shoot-em-up game similar in favour to *Centipede* but with its own attraction.

On screen you get a side view of the cactus and the ground level. You may move above or below the ground via holes in the ground. The swarm of wasps and harnets approach from above and fly from side to side slowly moving downwards. You must prevent them from reaching the base of the cactus where they can do the most damage.

Unfortunately, it isn't a simple matter of shooting the wasps. Moles move from side to side trying to fit in the holes in the ground and eat off your means of access. Now, of course, can shoot them. After screen one, vultures fly across dropping eggs. These bounce about and will destroy you on contact.

Graphically, the game is simple with limited use of the C16's colour abilities. The animation of the wasps is quite good, but overall the graphics don't really look like the creatures they are

supposed to be. Sound is limited to zapping noises although a nice version of *Invaderman* *Becker* has been added. Whilst this game doesn't break new ground in sophistication, it presents a real challenge. The first screen is deceptively easy, but our friends the vultures make life pretty tricky later.

They seem to aim their eggs accurately and the bouncing bomb behaviour of the eggs is tricky to judge.

Overall, not a bad game especially bearing in mind the lack of material for the C16. The rather primitive graphics do the game no favours but it does offer a good old fashioned zapping session.

M.B.C.

WORD PERFECT

Supersoft 010.00 disk

1 - 9

CM

I dare say that a good many owners of the 64 have considered the benefits to be derived from using a word processor but have been deterred by the high price of most of the programs currently available.

Even if you don't own a printer, a word processor can still be extremely useful. How many of you, for instance, can sit down to write a letter and get it right first time without having to retype paragraphs, correct spelling or syntax errors, or even re-write the entire thing, perhaps several times? With the aid of a word processor and a little typing practice the whole task becomes very much easier. Using the screen as a sort of electronic note pad, you can organise your thoughts and correct any errors, all without committing anything to paper.

However, whilst appreciating the above, many people will be unable to justify the expense of a program which although very useful is somewhat limited in its application in the home. *Word Perfect* from Supersoft has recently been released and seems to be aimed at just such a market. The program is available in both disk and tape format, the disk version being the one reviewed here.

Word Perfect is a scaled down word processor and as such it is suited to any of the uses to which you would put a typewriter, but with most of the advantages of word processing. The program loaded quickly and reliably and resides in the protected RAM above Basic starting at 49132. Most of the important features of a word processor are there, although some of them such

W040 L254 C02M CLING SC001 SL001 L1234

Word Perfect Demo

Supersoft

Word Perfect can be used to underline and centre text apart from setting tabs (??) and margins (??).

as block move and copy are implemented in a somewhat crude fashion. You may search for a specific word or phrase, centre, underline, set tabs and merge previously saved text into the current work. You have the option of saving your finished document to tape or disk.

Although some of the more usual commands are missing, right justify and search with replace for instance, I don't feel that their absence will cause too much inconvenience.

The program allows the use of a wide range of printers although, as with all software that uses a printer, it would be

prudent to check that your particular set up works before buying.

Word Perfect comes complete with a well written 16 page booklet that should enable even the novice to quickly get to grips with the program. While perhaps not suited to serious office work, I feel it has a lot to offer the home user. This review was written with the aid of *Word Perfect* and I shall continue to use it in the future.

My copy of the manual has an error on page eight. To reformat a paragraph you should press **CTRL+M** in **CONTROL** Mode, not **M** as stated.

B.J.T.

MAIL ORDER MONSTERS

AtariSoft \$14.95



C64 • joystick

Although the title is different, this is one of the excellent Electronic Arts "Construction" titles.

The game starts by telling you to select a Monster, i.e., a basic body type. This varies from the Human Monster to wings and strange horn-like creatures.

Next, weapons must be selected to arm your particular beast. These range from laser rifles and grenades for the

Humans to rocket-propelled from the worms and of course deadly claws from the lizards.

Then the creatures travel to the teleport chamber where they are left whilst the controllers decide what type of control is to be assigned. One player will decide the terrain, and this should be chosen to give your creature the maximum advantage and your opponents the least. So if an gamer has an amphibious creature he should choose a terrain with lots of water thus confining his opponent to the land.

The other player must try to nullify the disadvantages of the terrain by selecting the type of combat. The first type is the simple demolition combat where each player will fight to the death with the creatures found in the arena and the opponent.

The second requires flags to be collected in order. Each flag is defended by an arena creature.

The third type is called the Horde.

this is when both creatures must work together to defeat an invading horde that comes from the top of the screen and is attempting to reach the bottom. The one who wins most battles wins.

As I mentioned, the arena contains "Urban Defenders". In a one player game all these creatures are played by the computer but in a two player game the creature is played by your opponent. So, if a creature runs into an urban defender, the screen changes to a combat screen and the two players battle to the death. This is done by selecting weapons and timing the enemy. This requires a great deal of dexterity and practice is recommended. If the player is victorious in his attack on the urban defender then the screen changes back to the large map and the game goes on.

In graphics on this game Atari's stunning bad noise of the construction series add. The game is a different matter as it is excellent and I found it extremely addictive.

G.S.D.

THE GREAT AMERICAN CROSS COUNTRY ROAD RACE

AtariSoft \$13.95

C64

At first glance the Great American Cross Country Road Race - T.G.A.C.C.R.R. from one end, you it takes too long to write - is like *AutoStorm* (Talespin), but after closer scrutiny I found some pleasing additions.

After you've chosen your route, which is at first a touch confusing in regards to not trying to follow the intricacies of a British Rail line table, you are shown the map which roughly shows your route between cities and the weather conditions you are likely to encounter. You can stream across the great American countryside/forest/ snow plains/etc. etc. from one sprawling downtown conurbation like San Francisco to another like Washington, experiencing sun and snow.

To progress I chose the U.S. Tour route which, as the name suggests, shows you to both right round the continent.

After the prologue, you're faced with the old hat track, down which you must guide you low string speed machine.

You have a certain amount of time to get from one check point to the next and you're expected to change gear using the joystick, while keeping an eye on your fuel. If you allow your RPM to stay in the "red-line" too long your engine blows up but it doesn't take too much skill to avoid this catastrophe.

Fuel consumption is, I found, another story. This particular hazard really wound me up. When you run out of gas you have to "push" your car to the next station. You do this by continuously pressing the fire button - I actually

boke my joystick doing this. I believe that this would not have been necessary if the gas stations were more clearly defined, because if you only just miss one you've got to go to the next one which is 100 miles down the road - infuriating!

The driver touches in this arcade game are what make a difference. As you travel the road, conditions change along

with the scenery and it gets dark - I liked that. If you get too fast you attract the attention of the fuzz and they put you into.

Altogether this is just another road-race game and, although clever in places with good scrolling graphics, I feel that once you've seen it there isn't a lot of difference in the rest - but this is certainly one of the best. G.P.



PINBALL CONSTRUCTION SET

Activision £14.95



GG4 • Joystick

The idea behind the construction series of games is that people could adapt a game which they liked to take on many different forms and levels of difficulty to suit to improve their enjoyment. This isn't the case with Pinball C.S.

The game is a representation of a pinball board which can be set up to the user's requirements. All manner of bumpers, flippers and fancy bits may be put together on the board in an attempt to find an interesting game. This is where the construction bit falls down as most fun is to be had in the construction-of-weird-and-



wonderful boards. Playing these boards soon becomes very boring indeed! As all the fun is in real pinball, it's the flashing lights and ping, pong, ding noise.

However, back to the game. As I mentioned, the game allows use of bumpers and flippers. It also has many advanced features such as a ball hopper which collects balls, and it's full at which point it releases them all putting four balls in play at once. Another interesting feature is the AND gate that allows special scores to be awarded for good play.

All in all I was disappointed by this. Nice idea but a boring game. **J.G.B.**

THE RATS

Modder and Shoggin £7.95



CM

As reported in the October issue of Your Commodore, Modder and Shoggin Software has released the computer version of that now age old horror story The Rats by James Herbert.

When I got my grubby little paws on, the game I could hardly wait to get it in the C24 and have a look - you see,

dear reader, I'd read the book and seen the film already and thought they were both terrible - so maybe I expected too much.

In the game you take the roles of various characters in the original story - except the rats, of course. You can, for instance, be anyone from the commander of defence to a random idiot, altogether, add to the general confusion, and this, in my opinion, is the only advantage generated by this attempt to mix all the aspects of micro-gaming into one package. I think it's a shame that the game doesn't live up to my expectations especially after the stunning graphics that are displayed after the animation sequence.

The game is staged in central London where the rats are easily taking over and it's your task, with the help of the defence forces and various randomly from the research and development people, to contain the hideous menace

within London, whilst keeping the three main characters alive and not at the expense of every last man jack in your defence forces. To fail in any part results in defeat and some supposedly horrifying graphics.

To afford the destruction of the rats you are given various tools and professional forces to help you and you must put into action flippers (one of your main characters) strategic belts to do this. This is done by showing a cursor again to pick the words (your choice of which is mindbogglingly limited) to build the command. Needless to say, I was shocked very quickly and often.

It is a good idea, but with the lack of atmosphere and the limitations imposed to the program I found it hard work and it lost my interest very quickly. Like I said, I'd read the book, seen the film, and now I've played the game. I think I would have preferred the plot—

G.P.

KAYAK

Creative Sparks — Sparklers £2.95



GG4 — Joystick

If you find it exciting to have a cold bath on a foggy Sunday afternoon in November, while Chopin's funeral march plays in the background, then this is the game for you! According to the rather ungrammatical cassette insert, your

mouth will be dry and your ears shaking with excitement — yes, all of it!

The idea of the game is that you paddle a canoe in the World White Water Slalom Championship. This involves two forays along a stretch of winding river, with 25 gates to negotiate, concentrating to keep the white pole to your left at each. The control you have over your craft is minimal. Attempting to turn quickly ends with you slamming the bank, at which point the program is as likely as not to take up altogether.

The "superb scrolling 3D" graphics, mentioned on the packaging, are in fact crude and jerky, with the price of your boat bobbing up and down in the foreground and slalom gates appearing, as if by magic, just in front of you. Making headway against the current is



practically impossible, and response to the joystick is very slow indeed. The game proceeds at the pace of a snail with usual.

The only sound-effect, apart from a discordant fanfare at the start, is like nothing so much as brushing a pair of shoes, or perhaps a veteran washing-machine. There is a high-pitched tone, of a sort, but even that is muted-coloured. The only other "did you have the stamina and strength to last the whole course?" — I very much doubt it!

If I repeat rather unkind, it is well deserved. This is the poorest game I have seen for a long time, and the last thing to do with it is cover the tabs on the cassette and record something else over the top. Unless, perhaps, you suffer from insomnia?

P.A.B.

This month Margaret Webb explains how adventure games can be used as a valuable educational aid.

Pet

Involving the manipulation of spatial concepts.

The mapping operations and the overall solution of the game need a rather special form of skill - the ability to think logically and apply lateral reasoning. A simple example is how to get past a first-breathing serpent which blocks your way when you're carrying a sword, a basket of water and wearing running shoes. You must kill the dragon, push him out with the water and run him to see your map and find another route.

The problem is to find the correct solution and the means to achieve it using thoughts, trial and error and patience. All useful skills for real life.

Most of the best adventures use text to convey information and accept instructions. These programs will help improve reading, increase vocabulary, spelling, comprehension and creative writing but not to an extreme degree.

That's the boring bit out of the way, let us look at what's available. It might be easiest to deal with them in rough age groups: this list is not exhaustive, simply a guide.

Under-teens

The Magic Sword (Database Publications) is a fantasy tale book plus a simple adventure. The adventure uses simple text with graphics and the instructions are mostly key commands. You must find the prince (who has been turned into a frog) so that he can save Princess Poppy from the wicked witch.

Danger Mouse is the Black Forest Chateau (Creative Sparks) is a graphics/text adventure with menu-driven commands and text. There are lots of wits and great fun, pretty too. Help Danger Mouse save the world from the Phebers.

Early Secondary (and Smart Little-Ums)

This age group seems to prefer arcade type action and there are a

range of tough graphics-only games to choose from. All of these require problem solving and lateral thought. Some worthy titles include: *Imperable Alchemist* (Bps), an arcade-style game requiring both physical and mental agility; *Ball of Fire* (Athena), a magic-type game involving exploration of a tomb and the lighting of bonfire magic; *Alchemist* (Alphons), in which you guide the fairy on her search for magic potions and plants; *Strongman* of the *Quickies*, search the dungeons, find the treasure kill the monster; *Shadowline* (Beyond) uses advanced graphics techniques. You control an intergalactic 'A' team trying to rescue an ambassador. *For No Man* (Gargoyles), a Celtic legend in which you help the hero find the seal of Calann, Iannan, Ithana IV (John Gold). *Dragons* and *Dungeons* style, you lead your band of heroes on a quest.

Teens to Old-Ums

The most challenging games tend to be text or text/graphics adventures. While graphics help brighten up a game, you should be aware that the pictures only rarely give clues to the solution of the game. The list of such games is endless. There are some excellent software houses who are almost guaranteed to produce excellent games.

Those of note are: *Infotrac* - disk only, heavy use of detailed and absorbing text - a sense of human vital. *Throne* worth looking at are the *Dark Biology* (izards and dragons), *Starwars* and *Suspended* between fiction and *Heck Hiker's Guide to the Galaxy* (humorous).

Level Nine - early games text only, later games use graphics. Complex games with many locations - text compression means detailed descriptions.

Adventure International - not the most complex games but have a very high content of puzzles. Great variety covering many types of scenarios. Later games include *Granada* and *Incredible Risk*.

Individual games of note are: *The Hobbit* (Melbourne House) - on the book, quite tough.

Seven Kingdom Valley (Bag Bytes) - superb graphics, complex and quite tough.

Fourth Dimension (Pharosimond) - amusing graphics, needs deep thought and a devious mind.

THIS MONTH INTENDING TO DISCUSS the value of adventures in educational aids. In contrast to the monthly adventure columnist, with whom I don't expect to compete, I will be advising the uninitiated, not preaching to the converted.

Many parents feel that programs other than educational software cannot be of any benefit to their children. This is simply untrue since we learn something no matter what task we're performing. The robots shoot the alien game may seem pointless but it does teach eye-hand co-ordination and helps improve reaction times. Adventures are a more subtle means of combining enjoyment with learning.

Before diving into the material, it would be best to try to describe what is meant by an adventure. Initially, adventures were simply word-games programmed on main frame computers. With the development of home micros, the games have changed form: first the text appeared graphics, then animation and interaction was developed and finally audio/visual story features appeared. All other similar benefits about in differing proportions.

Most adventures involve placing the player, or his alter-ego, in an artificial scenario. By use of various forms of instruction, the player embarks on to solve certain problems or achieve certain goals. The scenario can basically be anywhere and can be mapped on a piece of paper. A building, for example, can be drawn in terms of rooms and passages.

The first task usually attempted in an adventure is to map, by exploration, the area where you find yourself - just as you would in real life. This means that you may need to know such concepts as the points of the compass and left, right etc. The scenario is normally too complex to memorise, forcing you to draw some form of map. Again this is a tricky task

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Build a better BASIC

**Nick Hampshire adds
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BASIC.**

IN LAST MONTH'S ISSUE I gave all the intituitions and wedge routines needed to add extra commands to the BASIC of a C64 computer. Also included in that article was a single command CTL in this second article I am giving four new commands, APPEND, CHANGE, DUMP and FIND. These are very useful 'toolkit' type commands for editing a program and are consequently all used in direct mode.

These four new commands all require the wedge and initialization code - given last month - to be present in memory at the correct locations and that their command names and entry points are stored in the correct tables. It should also be noted that all these commands use common routines within each other and should therefore always be used as a set. To ensure that you have them correctly positioned the BASIC loader at the end of this article is a repeat of last month's with the three new commands added.

CHANGE

Abbreviated entry: **CHANGE**
Affected Basic abbreviations:
CHANGE = CH (change)
Notes: Hex \$H, \$H, \$H, \$H, \$H, \$H
386
Modes: Direct and program
Recommended modes: Direct
Only

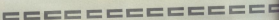
Purpose: To change all occurrences of a string or command to something else.

CHANGE

```

1000 CHANGE STR ADDRESS, NEXT LINE LINE
1010 JER FIND(4) :GET CURRENT CHAR
1020 STA ADR :STORE IN FLAG
1030 LSR #000
1040 JER FIND(4) :GET SEARCH STRING
1050 LSR #000
1060 JER CHANGE :GET STRING TO CHANGE
1070 STY NTC :STORE LENGTH OF CHANGE STRING
1080 JER FIND(4) :GET POINTERS
1090 BEI
1100 LSR #000
1110 STA FINDER
1120 LSR #000
1130 STA FINDER+1
1140 LSR #000
1150 STA FINDER+1 :ERROR LINE TO SYS
1160 JER FIND(4) :GET NEXT CHAR
1170 STA NTC+1
1180 JER NTC
1190 LSR #000
1200 JER FIND(4) :GET STRING
1210 CHANGE JER CHANGE :CHANGE
1220 CHANGE JER FIND(4) :GET LINE
1230 JER FIND(4) :GET STRING
1240 JER CHANGE :END REPEAT
1250 J
1260 CHANGE LSR NTC :LENGTH OF CHANGE STRING
1270 BEI
1280 SRC ADR + LENGTH OF FIND
1290 BEQ CHANGE :THEY ARE EQUAL
1300 JER CHANGE :ELSE CHANGE WITH
1310 CHANGE LSR NTC :LENGTH TO LINE
1320 LSR #000 :INDEX TO CHANGE STRING
1330 LSR #000
1340 JER #000 :GET BASIC ROM
1350 STA NTC
1360 CHANGE LSR #000 :GET CHANGE CHAR
1370 BEQ CHANGE :END OF STRING
1380 JER FIND(4) :REPLACE CHAR
1390 JER NEXT CHAR
1400 JER NEXT BYTE
1410 JER CHANGE :AND NEXT
1420 CHANGE LSR #000
1430 BEQ #000 :IF BASIC ROM
1440 STA NTC
1450 BEI
1460 STY ADR :STORE LINE INDEX
1470 JER CHANGE :GET NEXT FIND
1480 J
1490 CHANGE JER FIND(4) :GET NEXT CHAR
1500 JER NTC :GET THE FLAG
1510 BEQ CHANGE :YES, GET STRING
1520 JER #000
1530 CHANGE JER FIND(4) :GET NEXT CHAR
1540 BEQ CHANGE :END OF LINE
1550 JER NTC :END OF STRING
1560 BEQ CHANGE :YES
1570 STA NTC+1 :STORE CHAR
1580 BEI
1590 JER #000 :STRING TOO LONG
1600 JER CHANGE :NO
1610 LSR #000 :STRING TOO LONG
1620 JER NTC :GET NEXT CHAR
1630 CHANGE LSR #000 :STRING TERMINATOR
1640 STA NTC+1 :STORE IT
1650 BEI
1660 CHANGE LSR #000
1670 LSR #000 :GET LINE INDEX
1680 STA NTC :STORE IT
1690 LSR #000
1700 BEI
1710 LSR #000 :GET LINE INDEX
1720 STA NTC :STORE IT
1730 LSR #000
1740 CHANGE LSR
1750 JER ADR :SEARCHED STRING
1760 BEQ CHANGE :YES, INSERT IT
1770 LSR #000 :GET PROGRAM BYTE
1780 STA NTC+1 :STORE IN BUFFER
1790 BEI
1800 JER #000 :BUFFER TOO LARGE?
1810 BEQ CHANGE :GET IT
1820 CHANGE LSR #000
1830 JER #000 :GET BASIC ROM
1840 STA NTC
1850 LSR #000
1860 CHANGE LSR #000 :GET CHANGE STRING BYTE
1870 BEQ CHANGE :END OF STRING
1880 STA NTC+1 :STORE IN BUFFER
1890 JER NEXT CHAR
1900 JER #000 :END OF BUFFER
1910 JER CHANGE :NO
1920 CHANGE LSR #000
1930 STA NTC :END BASIC ROM

```



```

1740 STA #01
1750 LDA #02 :CALCULATE START
1760 CLC :OF REST OF PROGRAM LINE
1770 ADC #02 :AFTER INCREMENTING P#
1780 TAY :CHANGE STRING
1790 LDA #02
2000 CLC
2010 ADC #02
2020 STY #02
2030 SEC #02
2040 CHART# LDA #021,0 :GET PROGRAM BYTE
2050 STY #0200,0 :STORE IN BUFFER
2060 JMP #NEXT BYTE
2070 DBC #NEXT DBC#
2080 CMP #000 :END OF LINE?
2090 BCC CHART# :YES
2100 CPY #000 :END OF BUFFER
2110 BNE CHART# :NOT YET
2120 LDA #000 :END OF END OF BUFFER
2130 STY #000,0 :STORE IT
2140 DBC
2150 CHART# STY CHART# :STORE LENGTH OF
2160 TBA :LINE
2170 CLC
2180 ADC #004
2190 STY #00
2200 STY #0000
2210 STY CHART#
2220 LDA #0000
2230 STY CHART#+1
2240 LDA #CHART# :ASCII ADDR START
2250 STY #0000 :END-ENTRY POINT
2260 LDA #CHART#
2270 STY #0000
2280 STY #0000 :SAVE POINTERS ETC
2290 STY #00 :GET POINTER
2300 CMP #0000 :CHECK PROGRAM LINE
2310 CHART# LDA CHART# :RESTORE ADDR START :NEXT
2320 STY #0000
2330 LDA CHART#+1
2340 STY #0000
2350 STY #0000 :RESTORE POINTERS ETC
2360 LDA #02 :LAST LINE?
2370 DBC #02
2380 SEC CHART# :NOT YET
2390 LDA #02
2400 CMP #02
2410 BEQ CHART# :YES
2420 CHART# LDA CHART# :DID WE DELETE
2430 CMP #001 :SMALL COUNT?
2440 BEQ CHART# :YES
2450 CMP CHART# AND LIST AND GO NEXT?
2460 CHART# LDA #000 :CHART TO NEXT LINE
2470 STY #02
2480 LDA #000
2490 CMP CHART#+1 :GO NEXT WITHOUT LIST
2500 CHART# JMP #0010 :EXIT CHANGE
2510 CHART# STY 0
2520 CHART# :NOT 0
2530 :END

```

Each line that is changed is listed if there is anything left to list.

Syntax: CHANGE char delin d - where d is a delimiter character that does not appear in either of the strings del1 or del2.

Errors: Syntax error - if the format is not as above, string too long - if either del1 or del2 are longer than 40 characters. User CHANGE has a number of uses. An example would be:

CHANGE PRINT PRINT#.

To change all occurrences of PRINT to PRINT#4, or

CHANGE "PRINT" "PRINT#4,"

which will change all occurrences of the line PRINT to the line PRINT#4.

Note: Not all delimiter characters will work in all cases, for example:

CHANGE /BINARY/

As the character "/" has two values the first is the token for divide and the second is just the ASCII slash character.

The same is true of DATA. Other characters that will have the same effect are: "<" and ">".

DUMP

```

1000 DUMP LDA #02 :GET START OF VARIABLES
1010 STY #00 :AND STORE IN REGISTER
1020 LDA #02 : LOCATIONS
1030 STY #00
1040 :
1050 DUMP#1 SEC :START OF MAIN LOOP
1060 SEC #02 :END OF VARIABLES?
1070 LDA #02
1080 SEC #02
1090 SEC DUMP#2 AND
1100 CMP DUMP#2 :YES, DISPLAY ADDR ETC
1110 :
1120 DUMP#1 JMP DUMP#2 :GET NEW NAME
1130 LDA #02 :REAL?
1140 BEQ DUMP#2 :YES
1150 CMP #001 :FUNCTION?
1160 BEQ DUMP#2 :YES
1170 CMP #002 :STRING?
1180 BEQ DUMP#2 :YES
1190 LDA #02 :WANT BE DETAIL?
1200 JMP #0000 :PRINT YES
1210 JMP DUMP#2 :ANY EXTRA SPACES
1220 LDA #02
1230 JMP #0000 :PRINT " "
1240 LDA #0000 :GET POINTER TO VAL
1250 LDA DUMP#1 :GET LE
1260 PHA
1270 DBC
1280 LDA #021,0 :GET #0
1290 TAY
1300 PLA
1310 JMP #0000 :R10-R15#0
1320 :JMP #0000 :R16-R25#0
1330 LDA #0000 :PRINT IT
1340 JMP DUMP#2 :GO NEXT VAR
1350 :
1360 :REAL VARIABLE
1370 :
1380 DUMP#1 LDA #001
1390 STY #0200 :PRINT SPACE
1400 DUMP#2 :END NAME
1410 LDA #000
1420 JMP #0000 :PRINT " "
1430 JMP #0000 :GET ADDRESS OF VAR
1440 LDA #001 :DID I AND I
1450 LDA #000
1460 STY #0000 :R16-R25#0
1470 JMP #0000 :R10-R15#0

```

Baseline entry point: \$0005

Baseline operations: CHANGE uses most of the HAND routines to find del1 and list the line.

CHANGE reads in the delimiter byte and stores it away. The string to be changed is then read in until the second delimiter character is reached and stored. The next character is checked to see that it equals the delimiter character and if so the string to change to is read in until the delimiter character is found again or the end of command.

The rest of the routine is just a loop finding all occurrences, changing them and listing until the end of the program.

The actual routine that changes the string uses the basic input buffer and the basic routines to change a line. The routine copies the line up to del1 into the buffer, the change string (del2) is then copied to the buffer and the remainder of the line is copied over, the pointers are then set so that the next byte to check is the one following del2.

DUMP

Abbreviated entry: D(irect)U
Affected Basic abbreviations:
 None

Notation: Hex 88, 88C Decimal
 238,12

Modes: Direct and program.
Recommended mode: Direct
Purpose(s): To display the values of all simple variables, name functions, and display the dimensions of arrays.

Syntax: DUMP

Errors: None

Use: For debugging Basic programs, the DUMP command may be used after the program has run to get a list of all variables and their values. As an added bonus, not found in any other Debug command for the Commodore 64, all array dimensions are also given. The DUMP command will also display function names.

Routine entry point: 8888

Routine operation: The DUMP routine sets a pointer to the start of variables and checks for the end of variables. If it does not find any, the variable routine is used in and displayed, the variable type is determined, and the display is produced according to which type is required. When all simple variables have been processed, arrays are handled. The array names are read and displayed in the same way as the simple variables and the number of dimensions read off. The pointer is then set to the end of the dimension string and, reading backwards, the dimensions are read and displayed.

FIND

Abbreviated entry: F(ind)
Affected Basic abbreviations:
 None

Notation: Hex 888E Decimal
 238,34

Modes: Direct and program.
Recommended mode: Direct only

Purpose(s): To find all occurrences of a string or command inside a Basic program.

Syntax: FIND string -where string is the delimiter character as in CHANGE

Errors: Syntax error - if the syntax is not as above, string too long - if the string is longer than 40 characters.

Use: FIND is another useful routine for debugging and

DUMP

0000 J00 40000 /PRINT NUMBER

0000 J00 DUMP0 /DO NEXT VAR

0000 :

0010 /FUNCTION

0000 :

0000 DUMP0 J00 DUMP10 /VAR NAME

0000 J00 R/FUNCT1 /PRINT 10

0000 J00 R/FUNCT1 /FUNCTION*

0000 J00 NAME /PRINT STRING

0010 J00 DUMP0 /DO NEXT VAR

0000 FUNCT1 /PRINT "FUNCTION",100

0000 :

0000 /STR:VAR VARIABLE

0010 :

0000 DUMP0 J00 NAME /PRINT "VAR"

0000 DUMP0 J00 DUMP10

0000 J00 R/FUNCT1

0000 J00 R/FUNCT1

0000 J00 R/FUNCT1

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0000 J00 R/FUNCT1

0000 J00 R/FUNCT1

0000 J00 R/FUNCT1

0000 J00 R/FUNCT1

0000 J00 R /PRINT 100 /DO NEXT

0000 J00 R00

0000 J00 R /PRINT0 NAME BYTE

0000 J00 R000000 /PRINT NAME BYTE

0000 J00

0000 J00 DUMP0

0000 J00 R00 /PRINT NAME

0000 J00 R0000

0000 J00 R0000

0000 J00 R00 /PRINT 100

0000 J00 R0000 /PRINT 10

0000 J00 R0000 /PRINT 10

0000 J00 R0000 /PRINT 10

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CHURCH

[illegible]

100

000 FIND SET FIND14, GET CHARACTER	0034 SET MODE
0010 SET HSF, STORE IN FLAG	0040 CLT
0020 LDR W400	0050 JBR FIND10, FIND STRNG
0030 JBR FIND00, JOST SEARCH STRING	0060 FIND11, JBR FIND00, JOST LINE
0040 JBR FIND00, JOSTER POINTING	0070 JBR FIND00, FIND STRNG
0050 SET	0080 JBR FIND00, JAND HOPSET
0060 LDR W0000	0090:
0070 SET FIND00	0100 FIND00, JBR W400, JENDI STRNG SEARCH
0080 LDR W0001	0110:
0090 SET FIND00+1	0120 FIND00, JBR FIND00, SET A CHARACTER
0100 LDR W-FIND00, SEARCH LINK TO SET	0130 WFS FIND00, END OF LINK
0110 SET W0000	0140 WFS W00, LINK OF STRNG
0120 LDR W-FIND00	0150 WFS FIND00, WFS, COMPLETE

checking Basic programs, for example:

which will find and list all lines containing the command PRINT. If PRINT occurs more than once on a line, the line will be listed each time it is found with the exception of the last line where the line will be listed only once.

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Routing operations: The string to be found is read in within quotes, including spaces and colons and stored away. The rest of the program is a loop that searches the program until the string has been found, hits the line, and starts searching from the next character.

The error message vector is stored away and replaced with a jump to an "RTN" so that LHM will return to the routine.

APPENDIX

Abstracted from: *Journal of the American Academy of Child and Adolescent Psychiatry*, 1997, 36(12):1333-1340.

Address: _____
 City: _____
 State: _____
 Zip: _____

Model: Hs 40/40 Directional
200-1

References

Keywords: child sexual abuse; disclosure; social support

Purpose: To load a program into memory so that it appears 'on top' of the system program. This routine will work with both disk and cassette and the variable pointers when loaded are set to the end of the combined program. When this routine is used, you should check that the line numbers of the APPENDED program are larger than the line numbers of the program in memory.

Syntax: APPEND filename[,d,
s]) - where d is the device
number and s is the secondary
address.

Notes: The same order will be maintained as in the Basic program ICLAD.

Use: This routine would be used mostly to add Basic library routines onto the end of your programs. It would be used rather than `LIBCALL` because `APPEND` is much faster.

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Routine operations: The APPEND routine uses LOAD; parameter passing routine to get the filename etc, then sets the secondary address so that it loads at the end of the basic program in memory. The load

routine is then called and the program reinitialized and variable pointers set.

These extended Basic routines are all taken from the book *Advanced Commodore 64 Basic Revealed* by Nick Humphreys, published by Collins.



FIND

```

1200 STX #0FA0,0 :STORE IN SEARCH STRING
1210 INX
1220 CPE #0000 :STRING TOO LONG?
1230 BNC FINDER :NO
1240 LDA #0017 :STRING TOO LONG
1250 JMP #0017 :OUTPUT ERROR
1260 FINDER LDA #0000 :TERMINATOR TO STRING
1270 STX #0FA0,0 :STORE IT
1280 BTR #00 :STORE STRING LENGTH
1290 RTS :EXIT
1300 :
1310 FINDER LDA #00 :GET START OF PROG MEM
1320 CLT
1330 ADC #001 :PLUS 1
1340 STX #01
1350 LDA #00 :GET START OF PROG MEM
1360 BNC #0000
1370 STX #00 :STORE IT
1380 RTS
1390 :
1400 FINDER LDA #0000 :INDEX TO STRING
1410 LDA #0000 :INDEX TO LINE
1420 STX #02
1430 FINDER LDA #00
1440 LDA #0017 :GET BYTE
1450 BTR FINDER :END OF LINE
1460 CPE #0FA0,0 :SAME AS STRING?
1470 FCP
1480 LDA #00
1490 BNA #001 :IN BASIC ROM
1500 STX #01
1510 CLT
1520 BNC FINDER :NOT MATCHED
1530 BTR #0017 :GET BYTE
1540 LDA #0017 :CHANGE CHAR
1550 CPE #00 :STRING MATCHED?
1560 BNC FINDER :NO
1570 BTR #00
1580 FINDER LDA #02 :START AT NEXT BYTE
1590 LDA #00
1600 LDA #0000 :AND START OF STRING
1610 LDA #0017 :GET BYTE
1620 BNC FINDER :END OF LINE
1630 CPE FINDER :STX MATCH
1640 LDA #001 :IN BASIC ROM
1650 STX #01
1660 CLT
1670 BNC FINDER :NOT MATCHED
1680 BTR #0017 :GET BYTE
1690 LDA #0017 :CHANGE CHAR
1700 CPE FINDER :STX MATCH
1710 LDA #0017 :GET LINE ADDR
1720 LDA #0017 :GET LINE ADDR
1730 LDA #0017 :GET LINE ADDR
1740 LDA #0017 :GET LINE ADDR
1750 LDA #0017 :GET LINE ADDR
1760 LDA #0017 :GET LINE ADDR
1770 LDA #0017 :GET LINE ADDR
1780 LDA #0017 :GET LINE ADDR
1790 LDA #0017 :GET LINE ADDR
1800 LDA #0017 :GET LINE ADDR
1810 LDA #0017 :GET LINE ADDR
1820 LDA #0017 :GET LINE ADDR
1830 LDA #0017 :GET LINE ADDR
1840 LDA #0017 :GET LINE ADDR
1850 LDA #0017 :GET LINE ADDR
1860 LDA #0017 :GET LINE ADDR
1870 LDA #0017 :GET LINE ADDR
1880 LDA #0017 :GET LINE ADDR
1890 LDA #0017 :GET LINE ADDR
1900 LDA #0017 :GET LINE ADDR
1910 LDA #0017 :GET LINE ADDR
1920 LDA #0017 :GET LINE ADDR
1930 LDA #0017 :GET LINE ADDR
1940 LDA #0017 :GET LINE ADDR
1950 LDA #0017 :GET LINE ADDR
1960 LDA #0017 :GET LINE ADDR
1970 LDA #0017 :GET LINE ADDR
1980 LDA #0017 :GET LINE ADDR
1990 LDA #0017 :GET LINE ADDR

```

APPEND

```

1000 APPEND LDA #000          1180 SET : POINTERS TO END OF          1260 LDA #274
1001 STA #004                1190 SET #402 : NEW PROGRAM          1270 ADD #400
1002 JDR #004 : SET FILE PARAMETERS 1200 STA #01          1280 STA #254
1003 LDA #000                1210 TPA              1290 STA #054
1004 STA #001 : SET SA FOR ALT LOAD 1220 SET #400          1300 STA #054
1005 LDA #02                 1230 STA #274          1310 SET
1006 SET                    1240 ADDRESS LOY #000 : FIND END OF PROGRAM 1320 MOVNO LOY #000 : NOT YET END OF
1007 SET #402 : SET LOAD ADDRESS    1250 LDA #274,1 : AND SET VARIABLE 1330 LDA #274,1 : PROGRAM, GET
1008 TAC : DIRECTLY AFTER RESIDENT 1260 AND MOVNO : POINTERS 1340 STA #01 : ADDRESS OF NEXT
1009 LDA #001 : PROGRAM,          1270 JMP              1350 DRY : LINE,
1010 SET #000                1280 LDA #274,1          1360 LDA #274,1
1011 TAP                    1290 AND MOVNO          1370 STA #01
1012 LDA #004                1300 LDA #01          1380 LDA #00
1013 JDR #T00 : LOAD          1310 CLC              1390 STA #01
1014 :                        1320 ADD #402          1400 JMP #000
1015 MOVNO JDR #001 : NO-OWN LINE 1330 STA #02          1410 END
1016 LDA #02                 1340 STA #01          1420 END
1017 LOY #001 : NEXT VARIABLE 1350 STA #02

```

BASIC LOADER

```

100 REM *****
110 REM #BASIC LOADER FOR THE BASIC #
120 REM #EXTENSION PACKAGE #
130 REM #INCLUDES MENUES AND THE #
140 REM #COMMANDS #
150 REM #APPEND, CHANGE, CTL, DUMP AND#
160 REM #FIND #
170 REM #COPYRIGHT 20,8,85 #
180 REM #NICK HAMPSHIRE #
190 REM *****
200 I=1:W=0:L=32768
210 READA IFA=999THEN300
220 POKE1,R
230 L=L+1:I=I+1:W=W+R
240 GO TO210
300 IF I<>32927 THEN PRINT "NUMBER OF
DATA ENTRIES ERROR "I" SHOULD
BE 2307" :END
310 IF I<>341614 THEN PRINT "CHECKSUM
ERROR, VALUE "X" SHOULD BE
341614" :END
320 REM TO RUN ROUTINES SYS(64730)
330 REM
340 END
1000 DATA122,128,57,128,155,154,205
1010 DATA56,48,139,227,131,164,201
1020 DATA129,138,138,247,138,59,131
1030 DATA76,72,178,8,49,234,60
1040 DATA128,71,254,74,243,145,242
1050 DATA14,242,88,242,51,243,241
1060 DATA131,202,241,237,246,62,241
1070 DATA67,243,68,129,165,244,237
1080 DATA245,32,188,246,32,225,255

```



```

1090 DATA248,3,76,114,254,32,163
1100 DATA253,32,24,229,32,53,128
1110 DATA32,204,255,169,8,133,19
1120 DATA32,122,168,88,162,128,76
1130 DATA136,227,162,21,168,129,134
1140 DATA135,132,196,160,25,177,150
1150 DATA153,16,3,136,16,248,169
1160 DATA118,168,131,141,143,2,140
1170 DATA144,2,96,142,22,208,32
1180 DATA63,253,32,88,253,32,91
1190 DATA255,32,59,128,88,32,229
1200 DATA128,32,191,227,169,128,133
1210 DATA32,133,54,133,56,169,0
1220 DATA133,51,133,53,133,53,169
1230 DATA172,168,128,32,45,228,162
1240 DATA251,154,208,173,147,13,32
1250 DATA32,32,32,42,42,42,42
1260 DATA32,69,88,84,69,78,68
1270 DATA69,68,32,84,82,32,66
1280 DATA65,63,73,67,32,66,48
1290 DATA43,32,42,42,42,42,19
1300 DATA13,32,34,32,73,32,62
1310 DATA65,77,32,63,69,63,64

```

BASIC LOADER

```

1320 DATA63.77.32.32.0.142.11
1330 DATA189.9.128.157.0.3.202
1340 DATA16.247.96.82.85.206.67
1350 DATA84.204.65.80.50.69.70
1360 DATA196.63.85.84.207.67.65
1370 DATA84.65.76.79.199.67.72
1380 DATA65.78.71.197.67.72.65
1390 DATA73.206.67.82.85.78.67
1400 DATA200.69.69.76.69.84.197
1410 DATA68.73.83.203.68.79.75
1420 DATA197.68.65.77.208.69.80
1430 DATA69.195.79.73.78.196.71
1440 DATA69.212.75.69.217.77.65
1450 DATA212.77.69.82.71.197.79
1460 DATA76.196.80.79.200.80.85
1470 DATA212.82.69.79.85.77.66
1480 DATA69.210.82.69.80.69.65
1490 DATA212.83.79.82.212.84.82
1500 DATA65.67.69.79.206.94.82
1510 DATA65.67.69.79.70.190.84
1520 DATA69.68.197.85.78.84.73
1530 DATA94.68.69.69.203.72.73
1540 DATA77.69.205.76.79.77.69
1550 DATA205.86.65.82.88.84.210
1560 DATA0.36.139.138.138.137.138
1570 DATA39.139.42.139.116.134.45
1580 DATA139.48.139.51.139.54.139
1590 DATA57.139.187.135.68.139.135
1600 DATA137.63.139.66.139.69.139
1610 DATA72.139.75.139.78.139.61
1620 DATA139.84.139.87.139.90.139
1630 DATA93.139.96.139.99.139.102
1640 DATA139.105.139.108.139.111.139
1650 DATA114.139.106.122.160.4.132
1660 DATA15.189.0.2.16.7.201
1670 DATA255.240.43.232.208.244.201
1680 DATA32.240.36.139.0.201.34
1690 DATA240.71.36.15.112.26.201
1700 DATA33.208.4.169.153.208.18
1710 DATA201.48.144.4.201.60.144
1720 DATA10.76.70.130.169.238.44
1730 DATA5.11.164.113.232.200.153
1740 DATA251.1.201.238.240.49.185
1750 DATA251.1.240.34.56.233.58
1760 DATA240.4.201.73.200.2.133
1770 DATA15.56.233.85.208.174.133
1780 DATA9.189.0.2.240.219.197
1790 DATA9.240.215.200.153.251.1
1800 DATA232.200.240.153.252.1.196
1810 DATA123.169.255.133.122.36.185
1820 DATA11.208.193.251.1.76.207
1830 DATA129.132.113.160.255.134.122
1840 DATA202.169.1.133.11.200.202
1850 DATA189.0.2.56.249.241.128
1860 DATA240.245.201.129.240.156.160
1870 DATA122.240.11.200.185.240.128
1880 DATA16.250.185.241.129.200.220
1890 DATA160.0.132.11.136.166.122
1900 DATA202.200.232.189.0.3.54
1910 DATA249.158.160.240.245.201.128
1920 DATA288.3.76.255.129.166.122
1930 DATA238.11.200.185.157.160.16
1940 DATA258.185.158.160.208.225.100
1950 DATA0.2.76.1.130.40.3
1960 DATA76.243.168.201.255.240.249
1970 DATA36.15.48.245.201.238.240
1980 DATA5.32.217.130.40.3.32
1990 DATA186.130.76.239.166.200.177
2000 DATA95.170.132.73.160.255.202
2001 => N=>0
2010 DATA240.8.200.185.241.129.16
2020 DATA250.48.245.200.185.241.128
2030 DATA49.5.32.210.255.200.245
2040 DATA96.56.233.127.170.132.77
2050 DATA160.255.202.240.8.200.185
2060 DATA158.160.16.250.40.245.200
2070 DATA185.150.160.40.238.32.210
2080 DATA255.208.245.32.115.0.201
2090 DATA238.240.18.201.153.240.38
2100 DATA32.121.0.76.231.167.32
2110 DATA14.131.76.174.167.230.122
2120 DATA208.2.230.123.160.0.177
2130 DATA122.56.233.1.10.168.185
2140 DATA130.129.72.185.137.129.72
2150 DATA76.115.0.32.46.131.76
2160 DATA174.167.173.58.131.72.173
2170 DATA57.131.72.76.115.0.235
2180 DATA130.169.0.137.13.32.115
2190 DATA0.201.238.240.6.32.121
2200 DATA0.76.141.174.230.122.200
2210 DATA2.250.123.160.0.177.122
2220 DATA201.29.176.5.76.0.175
2230 DATA133.36.169.173.72.169.140
2240 DATA72.190.36.165.36.10.170
2250 DATA189.130.129.72.185.137.169
2260 DATA72.76.185.0.165.137.240
2270 DATA16.169.1.36.212.200.10
2280 DATA165.200.201.3.144.4.201
2290 DATA7.144.3.76.72.235.197
2300 DATA197.240.249.169.0.133.252
2310 DATA133.251.169.1.44.141.2
2320 DATA240.4.169.32.193.251.169
2330 DATA151.133.252.169.192.24.101
2340 DATA251.133.251.165.203.201.3
2350 DATA208.4.169.24.208.10.201
2360 DATA5.208.4.169.16.208.10
2370 DATA201.5.200.4.169.8.200
2380 DATA2.169.0.24.101.251.133
2390 DATA251.160.0.169.94.133.1
2400 DATA177.251.240.0.153.119.2
2410 DATA200.192.8.200.244.132.190

```

BASIC LOADERS

```

2420 DATA163,55,133,1,165,203,133
2430 DATA197,173,141,2,141,142,2
2440 DATA96,165,153,209,4,143,157
2450 DATA208,3,76,87,241,165,211
2460 DATA193,202,165,214,133,201,152
2470 DATA72,139,72,165,209,240,6
2480 DATA76,58,230,32,32,231,165
2490 DATA198,133,204,141,146,2,240
2500 DATA247,120,165,207,240,12,165
2510 DATA206,174,135,2,169,0,132
2520 DATA207,32,19,234,32,189,229
2530 DATA201,131,209,16,162,9,129
2540 DATA134,199,189,230,236,157,110
2550 DATA2,202,208,247,240,207,201
2560 DATA13,209,3,76,2,230,201
2570 DATA7,209,193,166,214,224,24
2580 DATA340,3,76,15,132,162,24
2590 DATA160,0,24,32,240,255,230
2600 DATA20,209,2,230,21,32,19
2610 DATA166,160,1,177,95,209,16
2620 DATA163,205,133,20,133,21,169
2630 DATA85,169,132,32,30,171,76
2640 DATA18,132,160,2,177,95,133
2650 DATA20,209,177,95,133,21,169
2660 DATA162,141,0,3,169,132,141
2670 DATA1,3,104,141,183,132,104
2680 DATA141,104,132,160,1,132,15
2690 DATA76,215,166,169,133,141,0
2700 DATA3,169,237,141,1,3,173
2710 DATA104,132,72,173,163,132,72
2720 DATA76,18,132,0,1,13,13
2730 DATA10,42,42,42,42,42,42
2740 DATA42,42,42,42,42,42,42
2750 DATA69,78,68,32,79,70,32
2760 DATA60,62,79,71,82,65,77
2770 DATA32,42,42,42,42,42,42
2780 DATA42,42,42,42,42,42,13
2790 DATA0,32,33,171,32,121,0
2800 DATA240,80,240,94,201,163,240
2810 DATA107,201,166,24,240,182,201
2820 DATA238,209,20,160,1,177,122
2830 DATA201,2,208,12,32,115,0
2840 DATA32,115,0,32,133,133,76
2850 DATA233,132,32,121,0,201,44
2860 DATA240,55,201,59,240,97,32
2870 DATA159,173,36,13,49,195,32
2880 DATA221,189,32,135,100,32,33
2890 DATA171,32,59,171,200,184,169
2900 DATA0,157,0,2,162,255,169
2910 DATA1,163,19,209,16,169,13
2920 DATA32,71,171,36,13,16,5
2930 DATA169,18,32,71,171,73,255
2940 DATA96,56,32,240,255,152,56
2950 DATA233,10,176,252,73,255,105
2960 DATA1,200,25,0,56,32,240
2970 DATA255,132,9,32,155,183,201
2980 DATA41,240,3,76,0,175,40
2990 DATA144,6,138,229,9,144,5
3000 DATA170,232,202,209,6,32,113
3010 DATA0,76,238,132,32,59,171
3020 DATA208,242,76,39,171,32,12
3030 DATA134,32,250,174,32,121,0
3040 DATA32,49,134,176,8,32,69
3050 DATA134,142,111,134,176,66,32
3060 DATA6,134,176,8,32,78,134
3070 DATA142,112,134,176,53,32,46
3080 DATA134,176,8,32,72,134,142
3090 DATA113,134,176,40,32,46,134
3100 DATA176,8,32,72,134,142,114
3110 DATA134,176,27,32,46,134,176
3120 DATA0,32,72,134,142,115,134
3130 DATA76,14,32,46,134,144,3
3140 DATA76,8,175,32,75,134,142
3150 DATA116,134,32,247,174,173,116
3160 DATA134,240,5,169,147,32,22
3170 DATA231,173,113,134,141,134,2
3180 DATA173,114,134,141,33,209,173
3190 DATA115,134,141,32,209,172,111
3200 DATA134,174,112,134,24,76,240
3210 DATA55,56,32,240,255,148,111
3220 DATA134,142,112,134,173,33,208
3230 DATA141,114,134,173,32,209,141
3240 DATA115,134,173,134,2,141,113
3250 DATA134,169,0,141,116,134,96
3260 DATA32,115,0,201,44,208,2
3270 DATA56,56,201,41,240,2,24
3280 DATA36,184,184,32,115,0,76
3290 DATA238,133,169,40,44,169,16
3300 DATA44,169,2,44,169,25,141
3310 DATA110,134,32,120,183,236,110
3320 DATA134,176,14,32,121,0,201
3330 DATA41,240,211,201,44,240,213
3340 DATA76,8,175,162,14,76,53
3350 DATA164,0,0,0,0,0,0
3360 DATA0,32,223,138,32,134,130
3370 DATA133,89,162,0,32,189,137
3380 DATA162,0,32,223,134,134,252
3390 DATA32,218,137,120,173,0,3
3400 DATA141,196,138,173,1,3,141,
3410 DATA197,138,169,92,141,0,3
3420 DATA169,130,141,1,3,80,32
3430 DATA232,137,76,179,134,32,93
3440 DATA130,32,238,137,76,167,134
3450 DATA165,252,56,223,94,240,3
3460 DATA76,5,135,164,35,162,64
3470 DATA165,1,41,254,133,1,189
3480 DATA64,191,240,7,145,87,232
3490 DATA200,76,199,134,163,1,3
3500 DATA1,133,1,136,132,35,76
3510 DATA170,134,32,120,130,197,89
3520 DATA240,3,76,8,175,32,120
3530 DATA138,240,17,197,89,240,13

```

BASIC LOADER

```

3540 DATA157,128,191,232,224,64,208
3550 DATA239,162,23,76,55,164,169
3560 DATA9,197,128,191,96,168,8
3570 DATA177,87,139,209,208,177,97
3580 DATA133,21,162,8,208,196,35
3590 DATA249,18,177,87,157,8,2
3600 DATA232,224,88,208,241,165,1
3610 DATA41,254,133,1,168,8,185
3620 DATA128,191,248,9,157,8,2
3630 DATA232,208,224,87,208,242,165
3640 DATA1,9,1,133,1,165,35
3650 DATA24,191,34,168,165,35,24
3660 DATA101,252,133,35,198,35,177
3670 DATA97,157,8,2,208,232,201
3680 DATA8,248,18,224,89,208,241
3690 DATA169,8,157,8,2,232,142
3700 DATA185,135,138,24,185,4,133
3710 DATA11,173,2,3,141,186,135
3720 DATA173,3,3,141,187,135,169
3730 DATA136,141,2,3,169,135,141
3740 DATA3,3,32,139,139,164,11
3750 DATA76,164,164,173,186,135,141
3760 DATA2,3,173,187,135,141,3
3770 DATA3,32,165,138,165,87,197
3780 DATA45,208,8,165,88,197,46
3790 DATA248,19,173,185,135,201,1
3800 DATA248,3,76,178,134,168,2
3810 DATA132,35,162,8,76,173,134
3820 DATA76,75,138,8,8,8,165
3830 DATA46,133,96,165,45,133,95
3840 DATA56,229,47,165,96,229,48
3850 DATA144,3,76,167,136,32,127
3860 DATA136,165,37,248,43,201,1
3870 DATA248,71,201,2,248,92,169
3880 DATA37,32,218,255,32,157,136
3890 DATA169,61,32,218,255,168,2
3900 DATA177,95,76,208,177,95,168
3910 DATA184,32,145,179,32,221,189
3920 DATA32,38,171,76,99,136,169
3930 DATA32,32,218,255,32,157,136
3940 DATA169,61,32,218,255,32,133
3950 DATA177,165,75,164,72,32,162
3960 DATA187,32,221,189,32,218,189
3970 DATA78,95,136,32,157,136,169
3980 DATA47,168,136,32,38,171,76
3990 DATA99,136,32,61,32,78,85
4000 DATA78,67,84,73,79,78,8
4010 DATA162,3,189,132,137,32,218
4020 DATA255,224,3,208,3,32,157
4030 DATA136,282,16,248,168,4,177
4040 DATA95,133,35,136,177,95,133
4050 DATA34,136,177,95,32,36,171
4060 DATA169,34,32,218,255,169,13
4070 DATA32,218,255,32,225,255,208
4080 DATA1,96,24,165,95,185,7
4090 DATA133,95,166,96,144,1,232
4100 DATA134,96,76,196,135,168,8
4110 DATA132,37,208,177,95,18,38
4120 DATA37,74,153,69,8,136,16
4130 DATA244,165,69,32,218,255,165
4140 DATA78,248,3,32,218,255,96
4150 DATA185,78,208,5,169,32,32
4160 DATA218,255,96,169,13,32,218
4170 DATA255,165,47,133,95,165,48
4180 DATA133,96,165,96,197,38,208
4190 DATA6,165,95,197,48,248,173
4200 DATA32,225,37,248,168,32,127
4210 DATA136,165,37,248,18,201,2
4220 DATA208,3,169,36,44,169,37
4230 DATA44,163,32,32,218,255,32
4240 DATA157,136,169,32,32,218,255
4250 DATA169,48,32,218,255,165,95
4260 DATA24,165,3,133,251,165,96
4270 DATA195,8,133,252,168,1,177
4280 DATA251,133,253,169,8,133,254
4290 DATA6,253,38,254,165,253,24
4300 DATA101,251,133,253,168,254,181
4310 DATA252,133,254,168,8,177,253
4320 DATA141,131,137,208,177,253,141
4330 DATA38,137,208,3,208,131,137
4340 DATA208,138,137,173,131,137,174
4350 DATA138,137,164,95,148,138,137
4360 DATA164,96,148,131,137,32,205
4370 DATA189,172,138,137,132,95,172
4380 DATA31,137,132,96,56,165,253
4390 DATA233,2,133,253,165,254,253
4400 DATA8,133,254,197,252,208,6
4410 DATA165,253,197,251,248,8,169
4420 DATA44,32,218,255,76,16,137
4430 DATA168,3,177,95,133,251,136
4440 DATA177,95,24,181,95,133,95
4450 DATA165,96,181,251,133,96,169
4460 DATA41,32,218,255,169,13,32
4470 DATA218,255,76,188,136,8,8
4480 DATA34,32,61,96,32,134,138
4490 DATA133,69,162,8,32,188,137
4500 DATA32,218,137,128,173,8,3
4510 DATA141,196,138,173,1,3,141
4520 DATA197,138,169,92,141,8,3
4530 DATA169,138,141,1,3,88,32
4540 DATA232,137,32,93,138,32,238
4550 DATA137,76,176,137,76,8,175
4560 DATA32,128,138,248,248,197,89
4570 DATA248,13,157,64,191,232,224
4580 DATA64,208,239,162,23,76,55
4590 DATA164,169,8,157,64,191,134
4600 DATA34,96,165,43,24,185,2
4610 DATA133,87,165,44,185,8,133
4620 DATA88,96,162,8,168,2,132
4630 DATA38,165,1,41,254,133,1
4640 DATA177,87,248,33,221,64,191
4650 DATA8,165,1,9,1,133,1

```


**Your Commodore's man in
the States, Burton Rubin,
attended the launch of the
Amiga. Here's his report plus
Brendin Lewis's impressions
of Metacomac — makers of
Amigados.**

US View

FOR THE PAST TWO YEARS, WSP's OF rumours, as insubstantial as smoke, have appeared in various magazines concerning the fabled, long awaited, Amiga computer. Originally called the Lorraine, the product of the Amiga Corporation, the machine, a 32 bit computer with fabulous graphics and sound capability, was to be the ultimate home computer.

Silicon Valley, as we all know, is littered with the bones of "ultimate home

computers". Times-Sinkole, Time-Instrumark, Coloco, Matral, and even the mighty Intel have all seen their offerings for the home market either away to a dusty death. When Jack Tramiel left Commodore, there was considerable speculation that his plan might be to purchase Amiga, (and with it, the rights to the wonderful Lorraine) and use the new machine as the sequel of the almost mythical Atari. By purchasing Amiga, Commodore beat Atari to the punch.

Commodore first exhibited the machine at the June, 1984 Consumer

THE AMIGA



The Amiga Specifications

Machine:	Commodore Amiga
Processor:	68000 at 7MHz
RAM:	128K standard; 256K expansion slot; Up to 512
OS:	1515 operating system.
Graphics:	320 x 200 12 colours; 320 x 400 12 colours; 640 x 400 16 colours; 640 x 400 16 colours. Colours selected from a palette of 4096.
Sound:	Four audio channels including stereo and speech.
Disk:	3 1/2 inch floppy 800kb.
Software:	Amigados, speech, Basic, Graphics.
MicroBuses:	Peripherals: Video/Disk unit, hard disk plus 512 byte RAM, colour monitor, modem. These system chips inside the Amiga take much of the processing burden away from the 68000. The very high speed graphics are handled by one of these chips.



Electronics show and its specifications were impressive. The Motorola 68000 was chosen for the central processing unit. This is a 32 bit chip with a 16 bit bus. Capable of addressing up to 16 megabytes of memory, it is the same chip that powers the Apple Macintosh. Tandy's response was the 1085T and 5265T, 32 bit machines running GEM. The Commodore camp responded with... silence. Sure, there was plenty on the sparkling, national new 128, and even pictures and publicity on the new notebook computer. But Commodore breathed easy a word about

Logic and Ltp will be available at the time of introduction, as well as a very powerful version of Microsoft Basic. Third party publishers will have more than 20 games available when the machine hits the shelves. Advertisers has already completed work on a videodisk interface.

The Amiga works through the new familiar system of menus, windows, icons, multitasking, and a mouse - first pioneered by Apple with the Lisa. Up to 30 windows can be open and running on the Amiga, though this is obviously more than anyone can manipulate without going

to Clavis QLT.

Irving Gould, Chairman of the company, sees the future of Commodore in "sophisticated, high end systems" with "excellent price/performance ratios" and "a full, rich, product line". This doesn't sound like the marketing philosophy that we've all grown to know and love.

The Amiga, though, is a machine capable of changing the philosophy of a company. Where the trusty old 484 was a Ford, and the Plus Four an Ideal, the Amiga is a Ferrari. The ultimate decision will be made in the marketplace. Don't bet against the Amiga.

The UK Connection

Tucked away in the corner of a small square in Bristol is the software house Metacomex. What is Metacomex? It is the company which has written AmigaDOS, the operating system for the new Commodore Amiga. Metacomex is not a large company - with a staff of 25 - but it does have a good track record, working on software for both the Sinclair QL and the Atari 128T.

Upon meeting a few of the staff it's quite easy to see that the firm's success is based on three main factors - sound management, expertise and, most notably, enthusiasm. Even some members of the senior management seem like small children playing with a new toy whenever the Amiga is mentioned. Even this cynical reporter was surprised at its performance. Though, as ever I'm still not totally convinced, I'll reserve final judgement for the full production model. Metacomex's staff, on the other hand, have had the word cynical totally erased from their memories. It was difficult for them to see a market into which the Amiga could not fit.

The whole story really started about three years ago when Amiga Inc. started work on a new machine. In November 1984, Commodore took over Amiga and then the machine. Prior to this though, Commodore had already approached Metacomex concerning Tapes (which is the framework around which AmigaDOS is built). From here, Metacomex has never looked back and has written various bits of software for the Amiga, including a version of Basic.

Although, for most of the day it was difficult to stop our host talking, I did finally get an amiable silence when I broached the subject of Amiga II. The only reply I did get was that, due to the open technology of the Amiga, the Japanese would be the first to produce an Amiga look-a-like and that ideas were already in the pipeline for something within the next 12 months.

Finally, my thanks to all at Metacomex for a very enjoyable day, and for providing what Commodore UK could not (or would not), a look at the Amiga.

UNVEILED

the larvae, and the rumours continued to fly.

At the official premiere of the Amiga computer, hosted (quite grandly) by Commodore at the Vivian Restaurant theatre at Lincoln Centre, the rumours all came true.

The specifications do not convey the power of the machine. The standard configuration of the Amiga includes a Motorola 68000 microprocessor, running at almost eight MHz, with 256K of RAM, internally expandable to 512K. The speed of this microprocessor is further aided by a proprietary three-chip set which links the 68000 from machine graphic and I/O tasks.

The Amiga is controlled by an 89 key keyboard with numeric keypad, cursor and special function keys, or a two-button mouse. It features a built-in three and a half inch disk drive (800K formatted), 80" 25 line text display, 640 x 400 resolution and a palette of 4096 colours (of which, any 16 can be on the screen at a time in high-resolution modes). There are parallel, serial, and second drive ports, two reconfigurable joystick ports, as well as text to voice and professional quality four channel multi-voice music synthesis capability. AtariST, Amiga GDS, and Amiga Tutor will be handled with the machine.

Software availability, the bane of all new computer introductions, would seem not to be a problem here. Thanks to the Intuition - a software option - the Amiga can run IBM PC compatible software packages like Lotus 1-2-3, Wordstar, and D Base III, in either 1.5 or 5.25 inch disk format.

In addition, when introduced in September, the Amiga will have available more than 20 programs including word processing, accounting, productivity, education, speech synthesis, telecommunications, paint, animation, and graphic programs. Assembler, C, Pascal,

Basic. The Intuition operating system, working through a system of "gadgets" makes windowing an easier and quicker task than it is on the Macintosh, or with the GEM operating system of the Atari.

The animation power of the machine is almost beyond description. It should open new vistas for anyone who needs professional visual aids, its value to the small advertising agency, or any small business should be incalculable. Combined with the phenomenal multitasking capability, Amiga should be a formidable weapon in the business wars.

With business applications firmly in mind, Commodore has chosen to merchandise the machine through specialist dealers. Long ago, Commodore pulled the plug on computer stores, in favour of mass market merchants.

The powers at Commodore are reversing the decision that made them such a commercial success and critical failure. It remains to be seen just how easily Commodore will be accepted by the same computer stores which were abandoned a few years ago.

At a list price of £1299, the Amiga represents excellent value. However, it's unlikely to be feared at the local K Mart.

My feeling is that acceptance in the computer stores may come gradually, but it will definitely come. The machine is simply too good to be ignored. The £1299 price tag includes a healthy mark-up for the dealers, and Commodore has signed up 688 RCA service locations to provide service support. With the advent of the Amiga, Commodore has both Apple and IBM lined up in its sights.

Thomas Bartigan, president of Commodore North America, is talking tough. "Commodore" he says, "is a strong, lean, aggressive organisation", and he intends to have the Amiga showcased in 12,000 outlets within a year of its introduction. He feels that the Amiga is a great leap forward (plaudits of



Split your 64's memory
with this useful little
program from Ray
Green.

SPLIT 64

Introduction

WHEN USING YOUR 64 TO develop Basic programs there are times when it would be useful to have another machine set up close to hand in order to run small utility programs, for instance: bus conversion, address calculation, etc. In schools, two pupils sharing one machine must be working on the same program unless a very disciplined approach is used. Split 64 is my attempt to solve these problems without incurring the cost of an extra machine.

Method

The program splits Basic memory into two areas of just over 14K, allowing the machine to hold two different Basic programs at the same time. Switching between areas is achieved by holding down the shift key and pressing the control key. Each area maintains the screen information from the last time you used it. The variable contents also remain intact. The second screen information is stored at the top of memory leaving approximately 3K free for things like electronics interface software. The area from 9C000 is also free for utilities.

In the initial start up of the program, I set the screen colours up to the normal blue for area (a) and green for area (b). If these are not to your liking then just change them with the normal F000s and the colours you set will be stored when switching between areas. If while using this program, run/stop restore is pressed, then a normal the screen will reset to blue and clear. However, the shift control switch will no longer work as to re-start Split 64 without losing your programs, type 9FF (35890) (previous). 9FF (35890) restarts Split 64 completely.

Basic Loader

```

1 REM *****
2 REM *
3 REM * R. GREEN 1/2/85
4 REM *
5 REM *****
6 A=35890
10 PRINT "(CLEAR)(DOWN)(RIGHT)(RIGHT)(RIG
HT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(R
IGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)
(RIGHT)(RIGHT)(RVSON)(SPLIT 64)(RUSOFF)"
15 PRINT "(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)
(DOWN)(DOWN)(DOWN)(DOWN)(DOWN)(RIGHT)(RIG
HT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(R
IGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)(RIGHT)
(RIGHT)(RIGHT) WORKING"
20 READ
25 C=C+1
30 IF C=0 THEN 40
35 POKEA,D:A=A+1:GOTO20
40 (FC=37263 THEN SYS(35890))
45 PRINT"(DOWN)(DOWN)ERROR IN DATA"
50 DATA162,16,169,46,141,141,134,2,202,1
60
55 DATA46,141,141,32,208,202,169,46,141,
141
60 DATA32,208,202,169,46,141,149,43,202,
16
65 DATA246,162,2,169,0,167,0,0,167,0
70 DATA74,202,16,247,32,34,229,32,120,14
0
75 DATA32,34,229,32,120,140,180,173,20,3
80 DATA72,173,21,3,72,169,87,141,20,3
85 DATA169,140,141,21,3,104,141,81,141,1
64
90 DATA141,80,141,89,76,118,164,173,141,
2
95 DATA201,6,208,23,165,207,208,19,166,1
57
100 DATA201,128,208,13,32,120,140,162,25
5,160
105 DATA255,136,208,253,262,208,240,108,
80,141

```



BASIC Loader (continued)

```

110 DATA162,16,173,174,2,72,183,63,141,1
111
115 DATA174,2,104,157,63,141,202,173,53,
208
120 DATA72,183,63,141,141,33,208,104,157
,63
125 DATA141,202,173,32,208,72,183,63,141
,141
130 DATA32,208,104,157,63,141,202,181,43
,72
135 DATA83,63,141,149,43,104,157,63,141
,202
140 DATA18,241,182,0,183,0,4,72,183,82
145 DATA141,157,0,4,104,157,82,141,183,0
150 DATA216,72,183,33,146,157,0,218,104,
157
155 DATA33,146,183,0,5,72,183,82,142,157
160 DATA0,5,104,157,82,142,183,0,217,72
165 DATA83,33,146,157,0,217,104,157,33,
146
170 DATA183,0,5,72,183,82,143,157,0,5
175 DATA104,157,82,143,183,0,218,72,183,
33
180 DATA147,157,0,218,104,157,33,147,183
,0
185 DATA7,72,183,82,144,157,0,7,104,157
190 DATA82,144,183,0,219,72,183,33,146,1
57
195 DATA0,219,104,157,33,146,232,224,0,2
08
200 DATA139,96,1,6,3,8,3,8,3,8
205 DATA0,74,0,74,0,74,234,245,14,1
210 DATA74,3,74,3,74,3,74,0,140,0
215 DATA140,0,140,245,240,13,0,0,-1

```

Entering the Program

To enter the program type in the Basic loader program, then SAVE it. Type RUN and the screen should flash, then clear to the normal Basic start up message. Note the much reduced free memory. Type in a short Basic program and RUN it. Stop the program, hold down the shift key and press control. The screen should now change colour and have the Basic start up message on it.

You are now in the second area. LIST and there should be no trace of the program you typed in. More control should take you back to the first screen and LIST will show your

program is still there. If you wish to make a machine code copy of split \$4 then list make sure you are in program area (a) before entering your machine code monitor. The start address is \$C0B0 and the end address \$D02E.

How it Works — General

Split \$4 takes advantage of the fact that the C64 operating system allows Basic to work within any free area of memory. To write your programs in another area of memory it is only necessary to change the pointers used by Basic in zero page. Change the

pointers back and any program that was there before will still be there. It is also possible to change the area of memory used by the screen but when writing this program it was decided to store the second screen along with the second colour map above Basic memory. The shift control switch is operated by a simple interrupt wedge.

How it Works — Machine Code

Initialise Routine

This routine sets up area (a) colours, memory start, memory

end, and variable pointers from values fixed in Table 1. It then puts zero in the first three locations of Basic memory for areas (a) and (b). It then calls the swap routine, which stores the current screen and loads the contents of the second screen (pubblik at this time). Having swapped screens the Basic start up program is called which clears the screen and prints the start up message. This procedure is then repeated for area (a). Finally the wedge routine address is inserted into the IRQ vector, the normal vector address having been saved, then back to basic.

Wedge Routine

The wedge routine is entered on every IRQ. It first checks location \$0280 to see if the shift control key is pressed. If not it jumps to the normal IRQ routine. If the key is pressed, it checks that the cursor is off and that the computer is not in ROM mode. When all three of these conditions are satisfied it calls the swap routine. After swapping areas a large delay loop is executed to avoid multiple swaps. Control is then passed to the normal IRQ routine.

Swap Basic

This is the first part of the swap subroutine. A loop is used to exchange the current screen, border and character colours, with the contents of Table 1. The same loop is used to exchange the Basic pointers (\$D30-\$D35) again with the contents of Table 1. On start up Table 2 contains the tiled values for area (b).

Swap Screen

Once more a loop is employed to exchange the current screen and colour map stored above Basic memory. The exchange is done right bytes at a time. Not the most elegant way to swap four areas of memory but it was chosen to cause minimum disruption to the screen during the swap.

Table 1

INITIALISE ROUTINE

8c00 a2 10	ldr #410	:index to table1
8c02 bd 2e 8d	lda #8d2e.x	:table1
8c05 8d 86 02	sta #0286	:char. colour area a
8c08 ca	dex	:next
8c09 bd 2e 8d	lda #8d2e.x	:table1
8c0c 8d 21 d0	sta #d021	:increase colour area a
8c0f ca	dex	:next
8c10 bd 2e 8d	lda #8d2e.x	:table1
8c13 8d 20 d0	sta #d020	:border colour area a
8c16 ca	dex	:next
8c17 bd 2e 8d	lda #8d2e.x	:table1
8c1a 95 2b	sta #2b.x	:basic memory size area a
8c1c ca	dex	:
8c1d 10 f8	bpl #8c17	:next
8c1f a2 02	ldr #402	:
8c21 a9 00	lda #400	:zero first 3 bytes in
8c23 9d 00 08	sta #0800.x	:both area a&b
8c26 9d 00 4a	sta #4a00.x	:
8c29 ca	dex	:
8c2a 10 f7	bpl #8c23	:
8c2c 20 22 e4	jer #e422	:basic start up a
8c2f 20 78 8c	jer #8c78	:swap area
8c32 20 22 e4	jer #e422	:basic start up b
8c35 20 78 8c	jer #8c78	:swap back
8c38 78	sei	:
8c39 ad 14 03	lca #0314	:irq low
8c3c 48	pha	:save it
8c3d ad 15 03	lda #0315	:irq high
8c40 48	pha	:save it
8c41 a9 57	lda #457	:low address wedge
8c43 8d 14 03	sta #0314	:irq vector
8c46 a9 8c	lda #88c	:high address wedge
8c48 8d 15 03	sta #0315	:irq vector
8c4b 68	pla	:recover address irq high
8c4c 8d 51 8d	sta #8d51	:store
8c4f 68	pla	:recover address irq low
8c50 8d 50 8d	sta #8d50	:store
8c53 58	cli	:
8c54 4c 74 a4	jmp #a474	:ready for basic

Table 2

WEDGE ROUTINE

8c57 a4 8d 02	lda #028d	:control shift pressed
8c5a c9 05	cmp ##05	:
8c5c d0 17	bne #8c75	:if not goto normal irq
8c5e a5 cf	lda #cf	:cursor off
8c60 d0 13	bne #8c75	:if not goto normal irq
8c62 a5 9d	lda #9d	:direct mode
8c64 c9 80	cmp ##80	:
8c66 d0 0d	bne #8c75	:if not goto normal irq
8c68 20 78 8c	jsr #8c78	:swap area
8c6b a2 ff	ldi ##ff	:
8c6d a0 ff	ldy ##ff	:
8c6f 00	dey	:delay to avoid key bounce
8c70 d0 fd	bne #8c6f	:
8c72 ca	sei	:
8c73 d0 f8	bne #8c6d	:
8c75 6c 50 8d	jmp (#8d50)	:jump to normal irq routine

Table 3

SWAP BASIC 2.PAGE LOCATIONS

8c78 a2 10	ldx ##10	:index to table2
8c7a ad 86 02	lda #0286	:char colour current
8c7d 48	pha	:save it
8c7e b4 3f 8d	lda #8d3f.:	:table2
8c81 8d 86 02	sta #0286	:change char colour
8c84 68	pla	:recover char colour
8c85 9d 3f 8d	sta #8d3f.:	:store in table2
8c88 ca	dex	:next
8c89 ad 21 d0	lda #d021	:current screen colour
8c8c 48	pha	:save it
8c8d b4 3f 8d	lda #8d3f.:	:table2
8c90 8d 21 d0	sta #d021	:change screen colour
8c93 68	pla	:recover screen colour
8c94 9d 3f 8d	sta #8d3f.:	:store in table2
8c97 ca	dex	:next
8c98 ad 20 d0	lda #d020	:current border colour
8c9b 48	pha	:save it
8c9c b4 3f 8d	lda #8d3f.:	:table2
8c9f 8d 20 d0	sta #d020	:change border colour

Table 3 continued

8ca2 48	pla	:recover border colour
8ca3 9d 3f 8d	sta #8d3f,x	:store in table2
8ca6 ca	dex	:next
8ca7 b5 2b	lda #2b,x	:basic memory size
8ca9 48	pha	:save
8caa bd 3f 8d	lda #8d3f,x	:table2
8cad 95 2b	sta #2b,x	:basic memory size...
8caf 48	pla	:recover
8cb0 9d 3f 8d	sta #8d3f,x	:store in table2
8cb3 ca	dex	:next
8cb4 10 f1	bpl #8ca7	:repeat for other 2 page locations

Table 4

SCREEN SWAP ROUTINE

8cb6 a2 00	ldx #400	:index for screen+colour mem
8cb8 bd 00 04	lda #0400,x	:screen mem
8cbb 48	pha	:save it
8cbc bd 52 8d	lda #8d52,x	:second screen
8cbf 9d 00 04	sta #0400,x	:store in screen
8cc2 68	pla	:recover
8cc3 9d 52 8d	sta #8d52,x	:store in second screen
8cc6 bd 00 48	lda #4800,x	:colour mem
8cc9 48	pha	:save it
8cca bd 5d 91	lda #915d,x	:second colour mem
8ccd 9d 00 48	sta #4800,x	:store in colour mem
8cd0 68	pla	:recover
8cd1 9d 5d 91	sta #915d,x	:store in second colour mem
8cd4 bd 00 05	lda #0500,x	: -----
8cd7 48	pha	:
8cd8 bd 52 8e	lda #8e52,x	:
8cdb 9d 00 05	sta #0500,x	:
8cde 48	pla	:
8cdf 9d 52 8e	sta #8e52,x	: same but plus 256
8ce2 bd 00 d9	lda #d900,x	:
8ce5 48	pha	:
8ce6 bd 5d 92	lda #925d,x	:
8ce9 9d 00 d9	sta #d900,x	:
8cec 68	pla	:
8ced 9d 5d 92	sta #925d,x	: -----
8cf0 bd 00 06	lda #0600,x	:
8cf3 48	pha	:

Table 4 (continued)

```

8cf4 bd 52 8f      lda #0f52.x      :
8cf7 9d 00 06     stia #0600.x      :
8cfa 68           pla              :      same but plus 512
8cfb 9d 52 8f     stia #0f52.x      :
8cfe bd 00 da     lda #da00.x      :
8d01 48           pha              :
8d02 bd 5d 93     lda #935d.x      :
8d05 9d 00 da     stia #da00.x      :
8d08 68           pla              :
8d09 9d 5d 93     stia #935d.x      :
8d0c bd 00 07     lda #0700.x      :
8d0f 48           pha              :
8d10 bd 52 90     lda #9052.x      :
8d13 9d 00 07     stia #0700.x      :
8d16 68           pla              :      same but plus 768
8d17 9d 52 90     stia #9052.x      :
8d1a bd 00 db     lda #db00.x      :
8d1d 48           pha              :
8d1e bd 5d 94     lda #945d.x      :
8d21 9d 00 db     stia #db00.x      :
8d24 68           pla              :
8d25 9d 5d 94     stia #945d.x      : -----
8d28 e8           inx              :next
8d29 e0 00        cpx #000         :255 done in each block
8d2b d0 8b        bne #8cb8        :if not then go back
8d2d 60           rts              :return

```

Table 5

TABLES

Contents shown as at start.

Table1

```

8d2e 01 flow s.a
8d2f 08 thig "
8d30 03 flow s.a
8d31 08 thig "
8d32 03 flow s.arrays
8d33 08 thig "
8d34 05 flow s.arrays
8d35 08 thig "

```

Table2

```

8d3f 01
8d40 4a
8d41 03
8d42 4a
8d43 03
8d44 4a
8d45 03
8d46 4a

```

```

8d36 00 flow b.active string 8d47 00
8d37 4a thig " " 8d48 0c
8d38 00 flow t/ " " 8d49 00
8d39 4a thig " " 8d4a 0c
8d3a 00 flow new top 8d4b 00
8d3b 4a thig " " 8d4c 0c
8d3c fe screen colour 8d4d f5
8d3d f5 border colour 8d4e f0
8d3e 0c bchan colour 8d4f 0d

```

Address for IR0.

```

8d50 31
8d51 ea

```


linear the triangular mesh becomes. But the results of this procedure do not resemble any natural phenomenon, simply because of their regularity. This is not a property to be found in nature, which is characterized by randomness.

We can produce an element of randomness by perturbing the mid-point of each side by a random amount, the variation of which is proportional to the length of its side. The left-hand illustration in Figure 2 shows the result of doing this and drawing the four smaller triangles produced by one sub-division. The right-hand illustration shows what happens after two sub-divisions, demonstrating that none of the triangles can be drawn until all the mid-points have been found and then perturbed. Continuing this process will give an increasingly mountain-like display. The range of the perturbation for the mid-point of each side or, if you like, the degree of proportionality between the range and the length of the side, effectively determines the fractional dimension of the final result. Different values for the range give quite different appearances to the mountain landscapes.

This gives us the following form for a graphics program to draw an artificial mountain landscape. It should declare the arrays to be used, and there will be several, because we must store the points for all the triangles in the final display as we cannot draw any of them until all their positions have been computed. Then it must read the co-ordinates of the corners of the basic triangle, prepare the high-resolution graphics screen, and carry out the sub-division of each side to give the points at the corners of the resulting triangles. To begin with, we will ignore the perturbations of the mid-points. This simplifies the program a little, gives results such as those in Figure 3, but provides a program which we can easily generalize to produce results like those in Figure 2. Finally, when the program has found the points for all the triangles, it only remains to plot them.

The main program based on this scheme is:

```

10 DIM C(400), Y(400), S(30), T(30), U(12), V(12),
  XT(400), YT(400)
20 FOR K=1 TO 3
30 READ X(K), Y(K)
40 NEXT K
50 DATA 150, 50, 250, 150, 50, 150
60 GOSUB 500: REM HI-RES SCREEN
70 FOR N=0 TO 1
80 FOR K=1 TO 4*N
90 GOSUB 4000: REM SUB-DIVIDE THE
  TRIANGLES
100 NEXT K
110 FOR K=1 TO 4*(N+1)*3
120 X(K)=XT(K): Y(K)=YT(K)
130 NEXT K
140 NEXT N
150 FOR K=1 TO 18
160 FOR J=1 TO 3
170 X(J)=X(J)+3*(K-1): Y(J)=Y(J)+3*(K-1)
180 NEXT J
190 GOSUB 3000: REM PLOT EACH TRIANGLE
200 NEXT K
210 END
500 POKE 53272, PEEK(53272) OR 8
510 POKE 53295, PEEK(53295) OR 32
520 FOR I=8192 TO 16192: POKE I, 0: NEXT I
530 FOR I=16192 TO 8023: POKE I, 255: NEXT I
540 RETURN
1000 SO=INT(C/8): CO=INT(C/8)
1010 L=R AND 7
1020 BIT=7 - (C AND 7)
1030 BYTE=B192 + SO*320 + CO*8 + L
1040 POKE BYTE, PEEK(BYTE) OR 2*BIT
1050 RETURN
2000 DX=X2-X1: DY=Y2-Y1
2010 IF DX=0 THEN 2070
2020 FOR C=X1 TO X2 STEP SGN(DX)
2030 M=INT(Y1+(C-X1)*DY/DX)
2040 GOSUB 1000: REM PLOT POINT
2050 NEXT C
2060 RETURN
2070 C=X1
2080 FOR R=Y1 TO Y2 STEP SGN(DY)
2090 GOSUB 1000: REM PLOT POINT
2100 NEXT R
2110 RETURN
3000 X1=S(3): Y1=T(3)
3010 FOR P=1 TO 3
3020 X2=S(P): Y2=T(P)
3030 GOSUB 2000: REM DRAW LINE
3040 X1=X2: Y1=Y2
3050 NEXT P
3060 RETURN
4000 FOR K=1 TO 3
4010 S(K)=X(K)+3*(K-1): T(K)=Y(K)+3*(K-1)
4020 NEXT K

```

Program Listing

```

10 DIM C(400), Y(400), S(30), T(30), U(12), V(12),
  XT(400), YT(400)
20 FOR K=1 TO 3
30 READ X(K), Y(K)
40 NEXT K
50 DATA 150, 50, 250, 150, 50, 150
60 GOSUB 500: REM HI-RES SCREEN
70 FOR N=0 TO 1
80 FOR K=1 TO 4*N
90 GOSUB 4000: REM SUB-DIVIDE THE TRIANGLES
100 NEXT K
110 FOR K=1 TO 4*(N+1)*3
120 X(K)=XT(K): Y(K)=YT(K)
130 NEXT K
140 NEXT N
150 FOR K=1 TO 18
160 FOR J=1 TO 3
170 X(J)=X(J)+3*(K-1): Y(J)=Y(J)+3*(K-1)
180 NEXT J
190 GOSUB 3000: REM PLOT EACH TRIANGLE
200 NEXT K
210 END
500 POKE 53272, PEEK(53272) OR 8
510 POKE 53295, PEEK(53295) OR 32
520 FOR I=8192 TO 16192: POKE I, 0: NEXT I
530 FOR I=16192 TO 8023: POKE I, 255: NEXT I
540 RETURN
1000 SO=INT(C/8): CO=INT(C/8)
1010 L=R AND 7
1020 BIT=7 - (C AND 7)
1030 BYTE=B192 + SO*320 + CO*8 + L
1040 POKE BYTE, PEEK(BYTE) OR 2*BIT
1050 RETURN
2000 DX=X2-X1: DY=Y2-Y1
2010 IF DX=0 THEN 2070
2020 FOR C=X1 TO X2 STEP SGN(DX)
2030 M=INT(Y1+(C-X1)*DY/DX)
2040 GOSUB 1000: REM PLOT POINT
2050 NEXT C
2060 RETURN
2070 C=X1
2080 FOR R=Y1 TO Y2 STEP SGN(DY)
2090 GOSUB 1000: REM PLOT POINT
2100 NEXT R
2110 RETURN
3000 X1=S(3): Y1=T(3)
3010 FOR P=1 TO 3
3020 X2=S(P): Y2=T(P)
3030 GOSUB 2000: REM DRAW LINE
3040 X1=X2: Y1=Y2
3050 NEXT P
3060 RETURN
4000 FOR K=1 TO 3
4010 S(K)=X(K)+3*(K-1): T(K)=Y(K)+3*(K-1)
4020 NEXT K

```

```

100 FOR B=1 TO 16
110 FOR I=1 TO 3
120 GOTO (2+5*B-1)*I: GOTO 3+5*B-10

```

```

130 NEXT I
140 GOSUB 380: REM PLOT EACH TRIANGLE
150 NEXT B
160 END

```

Here, the arrays are declared in line 10. The data, which is at line 50 and gives the position of the corners of the initial triangle, is read by lines 20 to 40. Line 41 calls the now-familiar subroutine, starting at line 380, for preparing the high-resolution graphics screen.

Lines 70 to 140 calculate and store the positions of the corners of all the triangles that result from the sub-dividing process. The outer loop variable, N, determines how many stages of sub-division occur in the program as presented; there are two stages, which are necessary to bring us to the position shown in the right-hand illustration of Figure 1. The first sub-division is done with N=0 and the second with N=1.

The inner loop variable, K, counts the number of triangles to be sub-divided. Initially, there will be one, and the value of K when N=0 is 1. After the first sub-division, there will be four, the value

Program Listing (cont.)

```

4030 GOSUB 5000: REM SUB-DIVIDE THIS TRIANGLE
4040 FOR M=1 TO 12
4050 XT(M)=12*(K-1)+UC(M): YT(M)=12*(K-1)+VC(M)
4060 NEXT M
4070 RETURN
5000 A1=(S(1)-S(3))*0.2*(RND(0)-0.5)
5010 B1=(S(1)-S(3))*0.2*(RND(0)-0.5)
5020 C1=(S(2)-S(3))*0.2*(RND(0)-0.5)
5030 A=0.5*(S(1)+S(2))+A1
5040 B=0.5*(T(1)+T(2))+B1
5050 D=0.5*(S(1)+S(3))+D1
5060 E=0.5*(T(1)+T(3))+E1
5070 C=0.5*(S(2)+S(3))+C1
5080 F=0.5*(T(2)+T(3))+F1
5090 UC1=S(1): UC4=S(2): UC7=S(3)
5100 VC1=T(1): VC4=T(2): VC7=T(3)
5110 UC2=A: UC5=B: UC12=A
5120 VC2=D: VC6=B: VC12=D
5130 UC3=E: UC8=C: UC11=E
5140 VC3=F: VC9=C: UC10=F
5150 UC5=F: UC9=C: UC10=C
5160 UC6=B: UC8=F: UC11=F
5170 RETURN

```

READY.

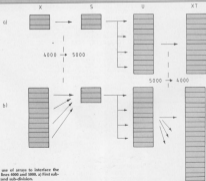


Figure 1. The use of arrays to initialize the sub-routines at lines 5000 and 5080. a) first sub-division b) second sub-division.

' signs. Now type SYS 12882 and you will notice that this character has not been changed.

The Program uses a very powerful raster interrupt, to enable the CBM set and the user defined graphics to be displayed at the same time. This routine also handles such effects as split screen colour etc.

Reading the next section should convince you of the value of this extremely powerful Character Generator.

Select

When you first use the Character Generator, you will notice four lines to the right of the grid, which generate status reports. The most significant of these is the first, i.e. Character Mode. On running the program, this is set to 'Edit', which is the default mode. In this mode, you are able to access all of the listed functions. However, if you press ' ', then the character mode will change to select.

Immediately, you will see that the cursor is no longer on the grid, but is now flashing on a line of characters which are directly below the grid. The only keys valid in this mode are Shift, Ctrl/V and 'T'.

Use the Ctrl/V key in the normal way (in conjunction with the Shift key) to locate the character you wish to edit. Now press 'T' and the character mode will return to 'Edit' and you will be able to experiment with the character you have selected.

Alternatively, as mentioned in the Function List, you may use functions 'B' and 'N' (Next Char & Last Char) to achieve the same result without ever having to enter the Select Mode.

Using the functions 'Set V' and 'Set -', choose the set that you want the original to be transferred to.

Now press 'Return', the transfer will be completed and normal operation resumed.

Recall

Since you ever made a complete view of a sprite or LDC that you were designing and wished you could restore it to its original form. This is what 'Recall' is for.

Every character you use is automatically 'buffered' so that in the event of you using the functions mentioned, pressing 'Recall' will restore the character to its original form.

A Finishing Note

Do not try to define your first blockdrawing character set immediately. Mess around with the various functions, until you become familiar with them. I hope you enjoy using it.

Description

- Positions cursor in top left of grid.
- As above and clears current character.
- Moves cursor right one space.
- Moves cursor left one space.
- Moves cursor down one space.
- Moves cursor up one space.
- Fills space at current cursor location.
- Deletes space to left of cursor.
- Runs space to right of cursor.
- Moves cursor on left of next line down.
- Fills left-right on current line.
- Deletes left-right on current line.
- Aligns code to move off the edge of the grid and appear on the opposite side.
- Keeps cursor within grid boundaries.
- Enables user to select the next character to be edited.
- Advances to next subset of 64 chars.
- Returns to previous subset.
- Allows the user to move to the next character without having to enter 'Select Mode' - see notes on 'B'.
- As above but moves backwards rather than forwards.
- Enables character multicolour mode.
- Disables character multicolour mode.
- Speeds cursor's response.
- Slows cursor response.
- Self explanatory.
- Self explanatory.
- Self explanatory.
- Self explanatory (split screen colour).
- Moves complete character right (1 bit).
- Moves complete character left (1 bit).
- Moves complete character down (1 bit).
- Moves complete character up (1 bit).
- Rotate character through 90 degrees 'R' - anticlockwise 'C' clockwise.
- Flips character upside down.
- Creates Mirror image of character through the vertical axis. (Works in bit/m & multicolour modes).
- Copies one character in the current set into another character in the same set.
- Transfers one complete set to another.
- 'Wills Char' Ctrl+V = Bn Set.
- Recalls 'buffered' character (See special notes on this function).
- Load character sets from tape or disk.
- Saves character sets to tape or disk. (Note: pressing 'V' will save the current subset 64 chars; pressing 'Ctrl+V' will save the entire four sets).
- Exit to Basic.

Transfer Set

To transfer a set of 64 characters to another location, first press Ctrl & 'T'. You should now see the Character Set no. (fourth status line) flashing.

Program Listing

```

0 REM .....
1 REM :
2 REM : CHARACTER GENERATOR :
3 REM :
4 REM : 4K PURE M/CODE :
5 REM :
6 REM : OVER 40 FUNCTIONS. :
7 REM :
8 REM : WRITTEN BY J.MC HALE :
9 REM :
10 REM : STRANDHILL RD., SLIGO. :
11 REM :
12 REM : REP. IRELAND. :
13 REM :
14 REM : DEDICATED TO :
15 REM :
16 REM : JENNIFER ..... :
17 REM :
18 REM : .....
```

Program Listing (cont.)

```

20 PRINT"CLEAR?".REM CLR/ROME
30 POKES3281,0:POKES3280,0
40 PRINT"YELLOWPLEASE WAIT, WRIT
ING CODE TO MEMORY ."
50 SA=18152:BC=0:TL=0
60 READR:IFA=-1THENGO
70 POKESA+BC,A:BC=BC+1:TL=TL+A:GOT
O60
80 REM = ERROR TRAPPING *
90 IFBC<>3882THENH00
100 IFTL<>48382THENH00
110 POKES3280,14:POKES3281,5:PRINT
"(CLEAR) 71".REM CLR/ROME & L18R
T BLUE ( CLR
& "71")
120 PRINT"DOWNOKAY = CODE ENTERED
D CORRECTLY ."
130 PRINT"DOWNYOU MAY NOW SAVE T
HE PROGRAM CODE TO "
140 PRINT"EITHER TAPE OR DISK."
150 DV=1
160 INPUT"DOWNWHICH DEVICE ( T O
R D ) : "ID
170 IFID<>"D"ANDID<>"T"THENGO
180 IFID="D"THENDV=D
190 IFDV=0THENH220
200 PRINT"DOWNPLACE IN/SONOBLANK
CASS/OPFI CASSETTE IN CON UNIT. REM
END"
210 PRINT"AND PRESS STOP/EJECT."&
OTD230
220 PRINT"PLACE (R/SON)FORMATTEDC
AS/OPFI DISK IN DRIVE#0 (DEV 0)."
230 PRINT"DOWNIDOWNPRESS ** WE
EN READY (DOWNIDOWN)"
240 POKEL88,0
250 GETAS:IFAS<>"**"THENH250
260 POKEL88,0:POKE2,DV:SYSS2222
270 PRINT"DOWNPLEASE VERIFY CODE
BY TYPING :
310 PRINT"DOWNTAPE VERSION = "VE
RIFY"CHR$(24)"CHR$(24)",1,1"
320 PRINT"DOWNDISK VERSION = "VE
RIFY"CHR$(24)"GEN'EN."CHR$(24)",B,
1"
330 PRINT"DOWNTHIS IS A PRECAUTI
ONARY MEASURE TO MAKE "
340 PRINT"SURE THAT THE CODE HAS B
EEN SAVED "
350 PRINT" CORRECTLY."
360 END
400 REM = ANALYSE ERRORS AND REPOR
T *
410 IFTL<>48382THENPRINT"DOWNJCH
ECKSUM ERROR."
420 IFBC<3882THENH460
430 IFBC<3882THENPRINT"DOWNINSUF
FICIENT ":GOTOH50
440 PRINT"DOWNID0 MAYY ":
450 PRINT"DATA ITEMS."
460 PRINT"DOWNIDDOWNCHECK DATA S
TATEMENTS CAREFULLY."&STOP
1000 DATA 160, 151, 146, 137, 148
, 148, 133, 142, 160, 130
1010 DATA 163, 160, 160, 186, 160
, 160, 138, 143, 136, 142
1020 DATA 160, 141, 131, 160, 136
, 163, 140, 133, 174, 160
1030 DATA 168, 131, 168, 160, 160
, 147, 133, 144, 148, 133
1040 DATA 141, 130, 133, 148, 160
, 160, 177, 165, 164, 160
1050 DATA 160, 171, 160, 160, 160
, 160, 160, 160, 131, 136
1060 DATA 163, 146, 160, 129, 148
, 133, 146, 160, 141, 143
1070 DATA 132, 133, 160, 186, 141
, 173, 131, 143, 140, 143
1080 DATA 148, 146, 160, 160, 141
, 143, 132, 133, 160, 166
1090 DATA 131, 136, 129, 148, 129
, 131, 148, 133, 146, 160
1100 DATA 160, 147, 133, 148, 160
, 166, 133, 133, 137, 148
1110 DATA 160, 160, 147, 133, 140
, 133, 131, 148, 143, 134
1120 DATA 134, 143, 142, 160, 168
, 147, 32, 210, 225, 163
1130 DATA 6, 141, 33, 208, 73, 8,
141, 38, 209, 162
1140 DATA 40, 163, 160, 157, 87,
8, 169, 7, 157, 87
1150 DATA 218, 208, 208, 243, 183
, 0, 162, 157, 11, 4
1160 DATA 183, 23, 152, 157, 91,
4, 169, 1, 157, 11
1170 DATA 216, 163, 3, 157, 91, 2

```

Program Listing (cont.)

```

18, 189, 189, 187, 171
1190 DATA 4, 157, 211, 4, 157, 25
1, 4, 157, 35, 8
1190 DATA 157, 75, 5, 157, 171, 2
15, 73, 1, 157, 75
1200 DATA 217, 157, 211, 218, 157
, 251, 218, 157, 35, 217
1210 DATA 232, 224, 23, 208, 155,
159, 0, 133, 251, 133
1220 DATA 253, 170, 189, 7, 133,
252, 159, 218, 133, 254
1230 DATA 160, 0, 163, 160, 145,
251, 163, 4, 145, 253
1240 DATA 200, 192, 11, 208, 243,
165, 251, 24, 105, 40
1250 DATA 133, 251, 133, 253, 165
, 252, 105, 0, 133, 252
1260 DATA 105, 212, 133, 254, 232
, 224, 11, 208, 217, 189
1270 DATA 72, 133, 251, 189, 4, 1
33, 252, 162, 176, 160
1280 DATA 3, 138, 145, 251, 163,
40, 4, 165, 251, 24
1290 DATA 105, 41, 133, 251, 165,
252, 105, 0, 133, 252
1300 DATA 136, 232, 224, 184, 208
, 231, 162, 0, 189, 58
1310 DATA 192, 157, 211, 7, 189,
74, 192, 157, 251, 4
1320 DATA 189, 188, 193, 157, 35,
5, 232, 224, 16, 208
1330 DATA 233, 36, 120, 173, 14,
220, 41, 254, 141, 14
1340 DATA 320, 173, 17, 208, 41,
127, 141, 17, 208, 163
1350 DATA 132, 141, 20, 3, 169, 1
53, 141, 21, 3, 169
1360 DATA 177, 141, 18, 208, 173,
25, 208, 3, 1, 141
1370 DATA 25, 208, 88, 86, 173, 2
5, 208, 3, 1, 141
1380 DATA 25, 208, 104, 168, 104,
179, 104, 84, 169, 1
1390 DATA 44, 25, 208, 240, 243,
173, 24, 208, 43, 8
1400 DATA 208, 40, 180, 88, 174,
18, 207, 169, 48, 141
1410 DATA 18, 208, 173, 14, 207,
208, 8, 173, 22, 208
1420 DATA 41, 239, 75, 174, 193,
173, 22, 208, 9, 16
1430 DATA 141, 22, 208, 142, 33,
208, 140, 24, 208, 75
1440 DATA 118, 133, 162, 8, 180,
20, 189, 177, 141, 18
1450 DATA 208, 75, 161, 193, 151,
148, 129, 144, 129, 145
1460 DATA 143, 149, 142, 132, 160
, 180, 180, 180, 180, 188
1470 DATA 133, 142, 159, 130, 140
, 133, 132, 180, 132, 137
1480 DATA 147, 125, 130, 140, 139
, 132, 120, 162, 42, 141
1490 DATA 20, 3, 162, 234, 141, 2
1, 3, 173, 14, 220
1500 DATA 8, 1, 141, 14, 220, 88,
58, 0, 0, 0
1510 DATA 173, 14, 220, 41, 254,
141, 14, 220, 165, 1
1520 DATA 41, 251, 133, 1, 162, 0
, 133, 251, 133, 253
1530 DATA 163, 208, 133, 252, 163
, 48, 133, 254, 162, 0
1540 DATA 160, 0, 177, 251, 145,
253, 208, 248, 238
1550 DATA 232, 230, 254, 232, 224
, 8, 208, 238, 189, 1
1560 DATA 3, 7, 133, 1, 173, 14,
220, 5, 1, 141
1570 DATA 14, 220, 234, 86, 168,
0, 133, 254, 182, 8
1580 DATA 10, 38, 254, 8, 252, 14
4, 7, 24, 101, 251
1590 DATA 144, 2, 230, 254, 202,
208, 239, 133, 253, 95
1600 DATA 173, 12, 207, 133, 251,
163, 8, 133, 252, 32
1610 DATA 82, 194, 165, 254, 24,
105, 48, 133, 254, 169
1620 DATA 82, 133, 248, 133, 251,
163, 4, 133, 250, 163
1630 DATA 218, 133, 252, 160, 0,
177, 253, 170, 152, 72
1640 DATA 139, 162, 8, 160, 0, 10
, 72, 144, 8, 168
1650 DATA 83, 145, 248, 145, 251,
208, 8, 168, 43, 145
1660 DATA 249, 168, 0, 145, 251,
104, 200, 208, 208, 231
1670 DATA 165, 248, 24, 105, 40,
133, 248, 133, 251, 165
1680 DATA 250, 165, 0, 133, 250,
105, 212, 133, 252, 104
1690 DATA 168, 200, 192, 8, 208,
185, 234, 95, 163, 64
1700 DATA 133, 251, 173, 13, 207,

```

Program Listing (cont.)

```

133, 252, 32, 62, 154
1710 DATA 162, 0, 160, 4, 163, 1,
163, 204, 217, 163
1720 DATA 8, 218, 138, 24, 101, 2
53, 153, 224, 5, 24
1730 DATA 105, 32, 153, 8, 6, 232
, 200, 192, 36, 208
1740 DATA 228, 169, 169, 133, 248
, 133, 250, 168, 8, 133
1750 DATA 249, 169, 218, 133, 251
, 169, 0, 133, 2, 162
1760 DATA 0, 160, 0, 138, 24, 101
, 253, 145, 248, 173
1770 DATA 18, 207, 72, 173, 14, 2
97, 210, 5, 104, 8
1780 DATA 8, 208, 1, 104, 145, 25
0, 232, 200, 192, 18
1790 DATA 208, 227, 165, 248, 24,
108, 80, 133, 248, 133
1800 DATA 250, 165, 249, 105, 0,
133, 249, 105, 212, 133
1810 DATA 251, 230, 2, 165, 2, 20
1, 4, 208, 198, 36
1820 DATA 163, 163, 133, 250, 133
, 252, 163, 6, 133, 251
1830 DATA 163, 218, 133, 253, 163
, 0, 133, 2, 170, 160
1840 DATA 0, 173, 12, 207, 145, 2
50, 138, 145, 252, 232
1850 DATA 200, 200, 192, 8, 208,
241, 165, 250, 24, 105
1860 DATA 80, 133, 250, 133, 252,
165, 251, 105, 0, 133
1870 DATA 251, 105, 212, 133, 253
, 230, 2, 165, 2, 201
1880 DATA 4, 208, 212, 36, 173, 4
, 207, 133, 250, 173
1890 DATA 5, 207, 133, 251, 172,
7, 207, 177, 250, 41
1900 DATA 63, 141, 12, 207, 169,
64, 133, 251, 173, 13
1910 DATA 207, 133, 252, 32, 62,
194, 173, 12, 207, 24
1920 DATA 101, 253, 141, 12, 207,
98, 173, 8, 207, 133
1930 DATA 250, 173, 5, 207, 133,
251, 172, 10, 207, 36
1940 DATA 32, 158, 135, 160, 0, 1
63, 0, 133, 2, 177
1950 DATA 250, 72, 74, 74, 74, 74
, 74, 74, 24, 101
1960 DATA 2, 133, 2, 104, 72, 10,
10, 10, 10, 10
1970 DATA 10, 24, 101, 2, 133, 2,
104, 72, 41, 48
1980 DATA 74, 74, 24, 101, 2, 133
, 2, 104, 41, 12
1990 DATA 10, 10, 24, 101, 2, 145
, 250, 200, 192, 8
2000 DATA 208, 199, 96, 32, 158,
195, 160, 0, 169, 0
2010 DATA 133, 2, 162, 8, 177, 25
0, 10, 72, 144, 9
2020 DATA 165, 2, 74, 5, 128, 133
, 2, 208, 2, 70
2030 DATA 2, 104, 202, 208, 237,
165, 2, 145, 250, 200
2040 DATA 192, 8, 208, 220, 96, 3
2, 158, 195, 169, 7
2050 DATA 133, 2, 160, 0, 152, 72
, 177, 250, 170, 164
2060 DATA 2, 177, 250, 72, 138, 1
45, 250, 104, 170, 104
2070 DATA 168, 138, 145, 250, 138
, 2, 200, 192, 4, 208
2080 DATA 228, 96, 152, 72, 177,
250, 164, 2, 145, 250
2090 DATA 104, 168, 96, 32, 158,
195, 169, 7, 133, 2
2100 DATA 160, 6, 32, 58, 196, 16
9, 0, 145, 250, 198
2110 DATA 2, 136, 192, 255, 208,
248, 36, 32, 158, 195
2120 DATA 162, 0, 134, 2, 160, 1,
32, 58, 196, 230
2130 DATA 2, 200, 192, 8, 208, 24
6, 136, 138, 145, 250
2140 DATA 96, 32, 158, 195, 160,
0, 177, 250, 10, 145
2150 DATA 250, 208, 192, 8, 208,
248, 96, 32, 158, 195
2160 DATA 163, 128, 133, 2, 160,
8, 163, 0, 153, 247
2170 DATA 207, 135, 208, 250, 152
, 72, 177, 250, 160, 0
2180 DATA 74, 144, 10, 72, 165, 2
48, 207, 6, 2, 163
2190 DATA 248, 207, 104, 200, 192
, 8, 208, 238, 70, 2
2200 DATA 104, 168, 200, 192, 8,
208, 223, 160, 0, 165
2210 DATA 248, 207, 145, 250, 200
, 198, 8, 208, 246, 36
2220 DATA 238, 18, 207, 96, 238,
34, 208, 96, 238, 36
2230 DATA 208, 96, 238, 38, 208,

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2240 DATA 173, 17, 207, 58, 233,
1, 208, 1, 58, 141
2250 DATA 17, 207, 58, 173, 17, 2
57, 24, 105, 1, 144
2260 DATA 244, 58, 173, 14, 207,
73, 1, 141, 14, 207
2270 DATA 38, 181, 133, 58, 172,
3, 207, 135, 208, 21
2280 DATA 173, 23, 207, 240, 15,
189, 1, 141, 11, 207
2290 DATA 185, 58, 141, 0, 208, 1
88, 8, 141, 3, 207
2300 DATA 58, 140, 3, 207, 14, 11
207, 173, 0, 208
2310 DATA 58, 233, 8, 141, 0, 208
58, 172, 3, 207
2320 DATA 200, 132, 9, 208, 21, 1
73, 23, 207, 240, 15
2330 DATA 189, 128, 141, 11, 207,
183, 40, 141, 0, 208
2340 DATA 183, 1, 141, 3, 207, 58
140, 3, 207, 78
2350 DATA 11, 207, 173, 0, 208, 2
4, 105, 8, 141, 0
2360 DATA 208, 58, 174, 2, 207, 2
58, 208, 30, 173, 23
2370 DATA 207, 240, 24, 188, 105,
141, 0, 207, 189, 5
2380 DATA 141, 1, 207, 182, 8, 14
2, 2, 207, 202, 142
2390 DATA 10, 207, 189, 122, 141,
1, 208, 58, 142, 2
2400 DATA 207, 208, 10, 207, 173,
0, 207, 58, 233, 40
2410 DATA 141, 0, 207, 173, 1, 20
7, 233, 0, 141, 1
2420 DATA 207, 173, 1, 208, 58, 2
33, 8, 141, 1, 208
2430 DATA 58, 174, 2, 207, 232, 2
24, 8, 208, 30, 173
2440 DATA 23, 207, 240, 24, 189,
81, 141, 0, 207, 189
2450 DATA 4, 141, 1, 207, 188, 1,
142, 2, 207, 202
2460 DATA 142, 10, 207, 189, 58,
141, 1, 208, 58, 142
2470 DATA 3, 207, 238, 10, 207, 1
73, 0, 207, 24, 105
2480 DATA 48, 141, 0, 207, 173, 1
207, 105, 0, 141
2490 DATA 1, 207, 173, 1, 208, 24
105, 8, 141, 1
2500 DATA 208, 58, 173, 141, 2, 4
1, 1, 208, 4, 32
2510 DATA 37, 187, 58, 32, 250, 1
58, 58, 173, 141, 2
2520 DATA 41, 1, 208, 4, 32, 151,
137, 58, 32, 82
2530 DATA 157, 58, 182, 83, 169,
0, 167, 64, 3, 202
2540 DATA 208, 250, 73, 255, 157,
84, 3, 232, 232, 232
2550 DATA 224, 24, 208, 245, 58,
189, 128, 182, 74, 180
2560 DATA 70, 141, 137, 195, 142,
155, 135, 140, 174, 198
2570 DATA 32, 133, 198, 58, 169,
1, 182, 10, 180, 8
2580 DATA 75, 25, 188, 173, 0, 20
7, 139, 250, 173, 1
2590 DATA 207, 133, 251, 172, 3,
207, 58, 32, 188, 132
2600 DATA 189, 8, 177, 250, 73, 2
55, 145, 250, 200, 188
2610 DATA 8, 208, 245, 58, 183, 0
133, 250, 173, 13
2620 DATA 207, 10, 24, 105, 48, 1
33, 251, 182, 0, 180
2630 DATA 0, 177, 250, 73, 255, 1
45, 250, 200, 208, 247
2640 DATA 230, 251, 232, 224, 2,
208, 238, 58, 173, 141
2650 DATA 2, 41, 4, 208, 4, 32, 8
1, 158, 58, 32
2660 DATA 78, 198, 58, 173, 21, 2
88, 73, 1, 141, 21
2670 DATA 208, 58, 173, 21, 208,
73, 2, 141, 21, 208
2680 DATA 58, 183, 10, 141, 124,
198, 32, 117, 135, 35
2690 DATA 188, 74, 208, 245, 32,
212, 130, 75, 188, 184
2700 DATA 173, 4, 207, 130, 250,
173, 5, 207, 133, 251
2710 DATA 172, 7, 207, 58, 32, 15
8, 195, 183, 0, 145
2720 DATA 250, 58, 32, 158, 133,
183, 253, 145, 250, 58
2730 DATA 173, 14, 207, 208, 4, 3
2, 235, 135, 58, 32
2740 DATA 172, 155, 58, 163, 82,
141, 1, 208, 183, 40
2750 DATA 141, 0, 208, 188, 81, 1
41, 0, 207, 189, 4
2760 DATA 141, 1, 207, 182, 1, 14

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2, 2, 207, 142, 3
2770 DATA 207, 202, 142, 10, 207,
189, 129, 141, 11, 207
2780 DATA 173, 141, 2, 41, 1, 208
, 1, 95, 32, 158
2790 DATA 155, 189, 0, 145, 250,
200, 132, 5, 208, 249
2800 DATA 95, 182, 0, 189, 90, 19
2, 157, 75, 5, 232
2810 DATA 224, 12, 208, 245, 95,
173, 12, 207, 24, 105
2820 DATA 175, 141, 92, 5, 182, 0
, 173, 15, 207, 208
2830 DATA 5, 189, 105, 132, 208,
3, 189, 112, 192, 157
2840 DATA 225, 4, 232, 224, 5, 23
8, 235, 173, 23, 207
2850 DATA 208, 5, 189, 215, 193,
208, 3, 189, 208, 193
2860 DATA 157, 45, 5, 232, 224, 1
4, 208, 235, 173, 14
2870 DATA 207, 208, 5, 189, 104,
192, 208, 3, 189, 107
2880 DATA 192, 157, 224, 4, 232,
224, 17, 208, 235, 32
2890 DATA 9, 199, 95, 32, 23, 199
, 208, 19, 207, 32
2900 DATA 199, 199, 95, 173, 23,
207, 73, 1, 141, 23
2910 DATA 207, 32, 23, 199, 95, 1
73, 12, 207, 133, 251
2920 DATA 189, 5, 133, 252, 32, 5
2, 194, 155, 253, 141
2930 DATA 8, 207, 189, 254, 24, 1
05, 48, 141, 3, 207
2940 DATA 95, 32, 189, 194, 32, 2
3, 189, 32, 115, 135
2950 DATA 32, 123, 199, 32, 98, 1
91, 32, 52, 195, 95
2960 DATA 173, 13, 207, 24, 105,
1, 201, 7, 208, 1
2970 DATA 95, 141, 13, 207, 75, 5
3, 202, 173, 13, 207
2980 DATA 55, 233, 1, 201, 255, 2
08, 240, 95, 173, 21
2990 DATA 208, 41, 1, 141, 21, 20
8, 95, 173, 21, 208
3000 DATA 3, 2, 141, 21, 208, 95,
172, 7, 207, 208
3010 DATA 193, 23, 208, 90, 174,
5, 207, 232, 224, 3
3020 DATA 208, 48, 173, 23, 207,
208, 1, 95, 32, 195
3030 DATA 199, 199, 227, 141, 4,
207, 189, 5, 141, 5
3040 DATA 207, 189, 145, 141, 3,
208, 183, 1, 141, 8
3050 DATA 207, 141, 7, 207, 189,
55, 141, 2, 208, 189
3060 DATA 0, 141, 18, 208, 32, 20
5, 195, 95, 142, 8
3070 DATA 207, 32, 195, 199, 173,
4, 207, 24, 105, 40
3080 DATA 141, 4, 207, 173, 5, 20
7, 105, 0, 141, 5
3090 DATA 207, 173, 3, 208, 24, 1
05, 8, 141, 3, 208
3100 DATA 189, 1, 208, 203, 140,
7, 207, 173, 2, 208
3110 DATA 24, 105, 8, 72, 144, 8,
173, 15, 208, 5
3120 DATA 2, 141, 18, 208, 104, 1
41, 2, 208, 95, 173
3130 DATA 7, 207, 135, 208, 88, 1
74, 8, 207, 208, 208
3140 DATA 75, 173, 23, 207, 208,
1, 95, 32, 195, 199
3150 DATA 189, 11, 141, 4, 207, 1
68, 5, 141, 5, 207
3160 DATA 189, 194, 141, 3, 208,
169, 2, 141, 8, 207
3170 DATA 189, 32, 141, 7, 207, 1
69, 48, 141, 2, 208
3180 DATA 189, 2, 141, 18, 208, 3
2, 205, 199, 95, 142
3190 DATA 5, 207, 32, 195, 199, 1
73, 4, 207, 55, 233
3200 DATA 40, 141, 4, 207, 173, 5
, 207, 233, 0, 141
3210 DATA 5, 207, 173, 3, 208, 55
, 233, 8, 141, 3
3220 DATA 208, 208, 203, 140, 7,
207, 173, 2, 208, 55
3230 DATA 233, 8, 72, 176, 5, 163
, 0, 141, 18, 208
3240 DATA 104, 141, 2, 208, 95, 1
69, 1, 141, 15, 207
3250 DATA 32, 23, 195, 32, 169, 2
55, 185, 157, 201, 2
3260 DATA 208, 28, 173, 141, 2, 4
1, 1, 208, 5, 32
3270 DATA 214, 199, 75, 230, 200,
32, 81, 200, 32, 2
3280 DATA 201, 32, 135, 199, 32,
155, 199, 75, 205, 200
3290 DATA 201, 14, 208, 240, 169,

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0, 141, 15, 207, 32
3300 DATA 83, 189, 32, 14, 201, 9
8, 172, 17, 207, 182
3310 DATA 0, 202, 208, 253, 136,
209, 248, 95, 32, 158
3320 DATA 195, 160, 0, 177, 250,
153, 240, 207, 200, 182
3330 DATA 8, 208, 246, 96, 32, 15
8, 195, 160, 0, 195
3340 DATA 240, 207, 145, 250, 200
, 192, 8, 208, 248, 96
3350 DATA 32, 214, 199, 78, 47, 2
02, 32, 81, 200, 78
3360 DATA 47, 202, 32, 158, 135,
173, 11, 207, 73, 255
3370 DATA 43, 250, 145, 250, 96,
32, 158, 195, 177, 250
3380 DATA 13, 11, 207, 145, 250,
32, 37, 197, 76, 99
3390 DATA 194, 32, 250, 196, 32,
58, 201, 78, 88, 184
3400 DATA 32, 58, 201, 32, 37, 12
7, 78, 88, 134, 32
3410 DATA 50, 137, 76, 151, 137,
0, 51, 2, 7, 50
3420 DATA 44, 0, 1, 21, 18, 50, 4
5, 53, 48, 46
3430 DATA 48, 54, 40, 43, 17, 33,
10, 20, 6, 3
3440 DATA 4, 5, 32, 57, 36, 58, 5
9, 8, 9, 82
3450 DATA 52, 13, 22, 0, 0, 0, 20
7, 222, 237, 56
3460 DATA 71, 87, 105, 186, 178,
218, 229, 208, 30, 104
3470 DATA 52, 48, 188, 188, 194,
21, 18, 38, 145, 154
3480 DATA 83, 88, 112, 188, 238,
200, 204, 198, 111, 170
3490 DATA 58, 23, 51, 0, 0, 0, 13
8, 137, 137, 201
3500 DATA 201, 201, 201, 199, 199
, 196, 196, 196, 201, 205
3510 DATA 201, 201, 199, 199, 199
, 196, 199, 199, 199, 199
3520 DATA 186, 186, 199, 199, 196
, 196, 196, 196, 195, 202
3530 DATA 205, 205, 205, 0, 0, 0,
32, 153, 255, 162
3540 DATA 0, 165, 197, 221, 112,
201, 208, 15, 189, 152
3550 DATA 201, 141, 46, 3, 189, 1
92, 201, 141, 47, 3
3560 DATA 108, 46, 3, 232, 224, 3
7, 208, 231, 55, 81
3570 DATA 4, 1, 1, 227, 5, 1, 1,
0, 48, 0
3580 DATA 128, 0, 0, 0, 0, 1, 40,
10, 0, 0
3590 DATA 1, 0, 1, 182, 0, 189, 9
, 202, 197, 0
3600 DATA 207, 232, 224, 24, 208,
245, 56, 32, 195, 199
3610 DATA 78, 14, 201, 32, 143, 1
99, 78, 14, 201, 183
3620 DATA 0, 32, 210, 255, 162, 0
, 32, 207, 255, 201
3630 DATA 13, 240, 10, 157, 32, 2
07, 232, 224, 15, 208
3640 DATA 241, 183, 13, 142, 22,
207, 32, 210, 255, 56
3650 DATA 183, 0, 141, 25, 208, 1
41, 21, 208, 183, 6
3660 DATA 141, 33, 208, 73, 8, 14
1, 32, 208, 189, 147
3670 DATA 32, 210, 255, 56, 183,
88, 141, 24, 208, 182
3680 DATA 0, 138, 157, 0, 4, 163,
1, 157, 0, 218
3690 DATA 232, 208, 244, 162, 0,
189, 149, 202, 32, 210
3700 DATA 255, 232, 224, 21, 208,
245, 108, 2, 3, 17
3710 DATA 17, 17, 17, 17, 17, 17,
13, 81, 85, 73
3720 DATA 84, 48, 13, 82, 63, 65,
88, 89, 48, 13
3730 DATA 32, 50, 202, 76, 125, 2
05, 12, 15, 1, 4
3740 DATA 58, 13, 1, 22, 5, 46, 1
73, 14, 220, 41
3750 DATA 254, 141, 14, 220, 165,
1, 41, 251, 123, 1
3760 DATA 168, 48, 139, 247, 189,
207, 139, 248, 182, 0
3770 DATA 139, 78, 189, 178, 202,
133, 251, 169, 8, 133
3780 DATA 252, 234, 32, 62, 184,
165, 254, 24, 105, 208
3790 DATA 133, 244, 160, 0, 177,
253, 145, 247, 200, 182
3800 DATA 8, 208, 247, 189, 247,
24, 105, 8, 133, 217
3810 DATA 165, 248, 105, 0, 133,
248, 104, 170, 232, 224
3820 DATA 10, 208, 203, 165, 1, 8

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, 7, 133, 1, 173
3830 DATA 14, 220, 5, 1, 141, 14,
220, 55, 173, 13
3840 DATA 207, 133, 255, 32, 153,
255, 155, 157, 201, 1
3850 DATA 240, 31, 201, 40, 209,
5, 32, 158, 159, 76
3860 DATA 53, 203, 201, 43, 208,
3, 32, 185, 189, 173
3870 DATA 92, 5, 73, 128, 141, 52
, 5, 32, 2, 201
3880 DATA 78, 27, 203, 173, 13, 2
57, 10, 24, 105, 48
3890 DATA 133, 253, 159, 0, 133,
250, 133, 252, 155, 255
3900 DATA 10, 24, 105, 48, 133, 2
51, 152, 0, 150, 0
3910 DATA 177, 250, 145, 252, 200
, 208, 243, 230, 251, 230
3920 DATA 253, 232, 224, 2, 208,
238, 155, 255, 141, 13
3930 DATA 207, 173, 82, 5, 9, 128
, 141, 92, 5, 76
3940 DATA 53, 202, 189, 80, 133,
247, 133, 249, 133, 251
3950 DATA 189, 4, 133, 248, 133,
250, 152, 0, 189, 72
3960 DATA 180, 0, 152, 72, 177, 2
53, 180, 0, 10, 174
3970 DATA 17, 72, 152, 150, 145,
245, 185, 250, 24, 105
3980 DATA 212, 133, 252, 159, 1,
145, 253, 104, 200, 182
3990 DATA 8, 208, 231, 185, 245,
24, 105, 40, 133, 245
4000 DATA 133, 251, 155, 250, 105
, 0, 133, 250, 104, 189
4010 DATA 200, 132, 8, 208, 203,
155, 247, 24, 105, 8
4020 DATA 133, 247, 133, 248, 133
, 251, 155, 248, 105, 0
4030 DATA 133, 248, 133, 250, 155
, 253, 24, 105, 8, 133
4040 DATA 253, 155, 254, 105, 0,
133, 254, 104, 170, 232
4050 DATA 224, 5, 208, 180, 58, 1
53, 207, 133, 254, 173
4060 DATA 20, 207, 208, 4, 152, 4
8, 208, 2, 159, 88
4070 DATA 133, 253, 78, 125, 203,
159, 0, 133, 250, 133
4080 DATA 252, 185, 170, 240, 5,
152, 48, 188, 55, 208
4090 DATA 8, 173, 13, 207, 32, 37
, 205, 234, 234, 133
4100 DATA 253, 134, 251, 55, 32,
32, 38, 17, 35, 32
4110 DATA 51, 32, 17, 21, 3, 20,
32, 55, 32, 38
4120 DATA 45, 38, 32, 51, 32, 20,
1, 18, 3, 32
4130 DATA 55, 32, 38, 55, 38, 32,
51, 32, 4, 9
4140 DATA 18, 11, 32, 32, 152, 40
, 189, 31, 204, 157
4150 DATA 183, 5, 153, 7, 157, 18
3, 217, 202, 208, 242
4160 DATA 55, 32, 2, 201, 152, 40
, 189, 183, 5, 73
4170 DATA 128, 157, 183, 5, 252,
208, 245, 55, 0, 29
4180 DATA 25, 28, 58, 78, 84, 53,
52, 32, 70, 73
4190 DATA 75, 53, 78, 55, 77, 58,
32, 55, 78, 58
4200 DATA 32, 80, 82, 58, 83, 83,
32, 38, 82, 58
4210 DATA 84, 85, 82, 78, 38, 13,
13, 28, 23, 23
4220 DATA 0, 70, 73, 76, 58, 78,
55, 77, 53, 32
4230 DATA 58, 32, 152, 13, 138, 3
2, 218, 255, 202, 208
4240 DATA 250, 189, 108, 204, 32,
210, 255, 232, 224, 54
4250 DATA 208, 245, 78, 55, 202,
32, 115, 205, 189, 0
4260 DATA 141, 32, 208, 141, 33,
208, 32, 238, 203, 32
4270 DATA 180, 204, 32, 72, 204,
234, 234, 234, 234
4280 DATA 234, 234, 32, 153, 255,
155, 157, 201, 52, 208
4290 DATA 3, 76, 252, 205, 201, 5
5, 208, 5, 159, 1
4300 DATA 78, 243, 204, 201, 27,
240, 5, 32, 59, 204
4310 DATA 78, 210, 204, 188, 8, 1
41, 21, 207, 188, 1
4320 DATA 188, 174, 21, 207, 32,
188, 255, 173, 52, 207
4330 DATA 152, 32, 180, 207, 32,
185, 255, 173, 20, 207
4340 DATA 208, 5, 32, 213, 255, 7
5, 32, 205, 32, 3
4350 DATA 204, 188, 250, 188, 252

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, 164, 253, 32, 216, 255
4360 DATA 104, 104, 76, 252, 205,
10, 24, 105, 48, 170
4370 DATA 105, 2, 95, 169, 0, 141
, 20, 207, 76, 183
4380 DATA 204, 169, 1, 208, 246,
173, 8, 207, 72, 173
4390 DATA 9, 207, 72, 32, 127, 20
0, 32, 169, 195, 104
4400 DATA 133, 253, 104, 133, 252
, 160, 0, 177, 252, 145
4410 DATA 250, 200, 192, 8, 208,
247, 76, 14, 201, 173
4420 DATA 141, 2, 41, 4, 205, 3,
76, 39, 206, 76
4430 DATA 22, 203, 173, 21, 208,
9, 2, 76, 17, 205
4440 DATA 76, 137, 200, 32, 90, 2
02, 169, 0, 139, 199
4450 DATA 78, 230, 183, 32, 230,
193, 163, 0, 133, 159
4460 DATA 104, 104, 76, 115, 202,
169, 0, 141, 16, 208
4470 DATA 141, 21, 208, 141, 23,
209, 141, 29, 209, 32
4480 DATA 252, 157, 163, 13, 141,
249, 7, 141, 249, 7
4490 DATA 169, 1, 141, 29, 208, 1
41, 40, 209, 169, 40
4500 DATA 141, 0, 208, 169, 66, 1
41, 1, 209, 169, 55
4510 DATA 141, 2, 208, 169, 149,
141, 3, 209, 234, 96
4520 DATA 234, 234, 234, 234, 234,
234, 234, 234, 32, 189
4530 DATA 202, 32, 137, 205, 92,
31, 202, 162, 8, 189
4540 DATA 255, 47, 157, 239, 207,
202, 209, 247, 32, 124
4550 DATA 192, 32, 76, 193, 32, 1
79, 189, 173, 21, 208
4560 DATA 41, 1, 141, 21, 208, 32
, 232, 201, 32, 88
4570 DATA 134, 32, 2, 201, 32, 12
7, 139, 76, 229, 205
4580 DATA 169, 2, 139, 2, 160, 0,
162, 0, 202, 209
4590 DATA 253, 136, 209, 249, 199
, 2, 209, 242, 78, 192
4600 DATA 205, 41, 2, 141, 21, 20
8, 76, 197, 200, 169
4610 DATA 0, 133, 170, 173, 141,
2, 41, 4, 133, 170
4620 DATA 76, 90, 206, 173, 21, 2
09, 41, 2, 141, 21
4630 DATA 209, 78, 57, 205, 169,
20, 141, 21, 209, 76
4640 DATA 53, 205, 169, 20, 141,
21, 209, 76, 42, 205
4650 DATA 3, 32, 8, 32, 1, 32, 19
, 32, 1, 32
4660 DATA 3, 32, 20, 32, 5, 32, 1
8, 32, 32, 7
4670 DATA 32, 5, 32, 14, 32, 5, 9
2, 19, 32, 1
4680 DATA 32, 20, 32, 15, 32, 19,
32, 39, 54, 52
4690 DATA 16, 32, 19, 32, 5, 32,
19, 32, 19, 32
4700 DATA 32, 1, 32, 14, 32, 25,
32, 32, 11, 32
4710 DATA 5, 32, 25, 32, 32, 32,
20, 32, 15, 32
4720 DATA 32, 19, 32, 20, 32, 1,
32, 19, 32, 20
4730 DATA 169, 48, 141, 17, 207,
234, 234, 234, 169, 147
4740 DATA 32, 210, 255, 169, 142,
32, 210, 255, 169, 9
4750 DATA 32, 210, 255, 169, 0, 1
41, 32, 209, 141, 33
4760 DATA 209, 189, 64, 133, 157,
182, 40, 189, 105, 209
4770 DATA 157, 183, 5, 169, 1, 15
7, 183, 217, 189, 65
4780 DATA 206, 157, 255, 3, 169,
7, 157, 255, 215, 209
4790 DATA 209, 231, 165, 197, 201
, 64, 240, 3, 76, 236
4800 DATA 206, 32, 99, 204, 162,
48, 189, 255, 3, 73
4810 DATA 129, 157, 255, 3, 202,
209, 245, 78, 209, 209
4820 DATA 173, 111, 201, 72, 209,
3, 32, 254, 193, 104
4830 DATA 9, 1, 141, 111, 201, 23
4, 234, 76, 192, 205
4840 DATA 169, 1, 189, 2, 180, 1,
32, 189, 255, 169
4850 DATA 7, 152, 35, 160, 207, 3
2, 189, 255, 169, 0
4860 DATA 133, 250, 189, 152, 133
, 251, 169, 250, 162, 0
4870 DATA 160, 207, 76, 216, 255,
71, 69, 78, 39, 54
4880 DATA 62, 46, -1

```

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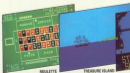
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Mike Hart provides a couple
of handy plotting routines for
the Vic 20 and C64.

RELIABLE ROUTINES

AT ONE TIME OR ANOTHER, MANY people must have experimented with their machines to see if there is an easy way to draw graphs or plots on the screen. There are three ways in which this can be done and I will call them low resolution, medium resolution and high resolution respectively.

In low-resolution plotting, one merely takes the screen as a grid and plot points using asterisks or a similar graphics characters. In the case of a C64 this would obviously be a grid of 40×25 giving 1000 potential plot points.

If one wished to use a high resolution screen then on the C64 one would use bit-mapped graphics which allows each individual 'dot' on the screen to be controlled. Using this mode will increase the resolution quite dramatically to 1024×1024 which is 1,048,576 addressable dots. However using the C64 in this mode is quite complicated and needs to be approached with a degree of caution. The approach which I am going to adopt here is one that gives pleasant 'chunky' graphics points and is half-way between these two extremes and which, therefore, I shall call medium-resolution graphics.

If you were to PRINT CHR\$(64), CHR\$(65), CHR\$(66) and CHR\$(67) you would see that a graphics character is generated which consists of a quarter square either by itself or in combination with another 'quarter square' to make up a half square. There are 16 of these combinations altogether and together with space and reverse space we have a total of sixteen permutations of 'quarter-square' graphics. This enables us to make a resolution which is twice that of the normal screen and therefore instead of having 40×25 we can increase this to 80×50 giving us a resolution of 4000 plot points.

Let us suppose that we wish to plot a point at the bottom left hand corner of the screen. The complicating factor that we have to take into account is that there might already be a graphics character already occupying that position and we would wish to preserve the point that it represents. The trick here is to PEEK the screen at that particular point, read the value of the character at that point, look up its value in a table of potential values and then work out from the same table the value of the new character to be plotted back onto the screen which last plot the 'new' point and the value of the existing point. If this is a little hard to visualise then any of Ramo-Wood's books have an excellent explanation under the

Program Listing

MEDIUM-RES PLOT

```
1 REM *** MEDIUM-RES PLOT (BASIC) ***
2 :
3 REM **      M. C. HART      **
4 :
5 DIM C(100),R(1,1)
6 FOR J=0 TO 10:READ C(J):NEXT J
7 DATA 32,123,188,98,188,87,157,88
8 DATA 124,225,225,234,225,225,231,188
9 :
10 R(0,0)=1:R(0,1)=2:R(1,0)=4:R(1,1)=8
11 :
12 :
13 :
14 FOR J=040 TO 500:READ H:POKE J,H:NEXT J
15 DATA 32,841,183,139,162,8,157,8
16 REM DATA 32,841,215,139,162,8,157,8
17 DATA 218,157,8,217,157,8,218,157
18 REM DATA 149,157,8,149,157,8,158,157
19 DATA 8,218,225,225,241,98
20 REM DATA 8,151,225,225,241,98
21 :
22 PRINT CHR$(147);CHR$(144);:REM BLACK
23 COL=0:REM BLACK
24 FOR J=0:124:POKE53286,124:POKE53287,124:REM GREY
25 REM VIC POKE 56679,25
26 :
27 SYS 940,COL,REM:SET COLOUR MEMORY
28 FOR J=1 TO 2:FOR H=0 TO 75
29 REM VIC FOR J=1 TO 2:FOR H=0 TO 75
30 T=22+21451516*(H/8)+65536:POKE T,REM
31 NEXT H:FOR T=1:157:POKE T,1:NEXT J
32 :
33 :
34 END REM VIC ONLY
35 :
36 REM PLOT SUBROUTINE
37 :
38 HL=INT(H/2)+1:HB=X-B*HL
39 HL=INT(H/2)+1:HB=INT(H/2)-B*HL
40 HB=X*(YB,HB)
41 P=1:84-48+Y*HL
42 REM VIC HB: P=4558-22+Y*HL
43 REM VIC HB: P=6164-22+Y*HL
44 FOR I=0:15:IF PEEK(P) < P(I) THEN NEXT I
45 :C OR MDP T=-1, THEN I=1 AND NOT(I)
46 POKE P,C(I):RETURN
47 :
48 :
49 :
```



Program Listing

```

0001 REM *** MEDIUM-RES PLOT ***
0002 REM
0003 REM ** BY H. C. HART **
0004 REM
0005 FOR J=000 TO 000:READ KIT+TIC
0006 FOR K,X=HCHT:IF T=00000 THEN 0009
0007 PRINT "DATA ERROR!" :END
0008 DATA 100,0,100,004,100,1,100,000
0009 DATA 100,001,001,000,170,000,100,000
0010 DATA 001,000,170,000,100,000,000,000
0011 DATA 70,001,000,004,100,000,004,100
0012 DATA 000,10,10,101,000,10,10,00
0013 DATA 000,10,00,000,004,004,004,100
0014 DATA 000,100,004,100,100,0,100,004
0015 DATA 104,001,177,000,100,10,001,100
0016 DATA 0,040,0,000,10,040,00,170
0017 DATA 100,0,040,0,100,0,004,170
0018 DATA 000,0,100,70,000,0,004,70
0019 DATA 000,170,100,100,0,104,001,140
0020 DATA 000,00,1,1,0,0,0,00
0021 DATA 100,100,07,104,000,000,000,100
0022 DATA 107,00,000,000,001,004,100,0
0023 DATA 00,041,100,100,100,0,107,0
0024 DATA 010,107,0,017,107,0,010,107
0025 DATA 0,010,000,000,041,00,00,000
0026 DATA 100,104,000,100,00,100,001,00
0027 DATA 041,100,140,100,0,00,100,0
0028 DATA 70,00,0
0029 :
0030 PLOT=070
0031 PRINT INPUT"BACKGROUND:";B
0032 PRINT INPUT"PEN COLOUR:";COL
0033 PRINT INPUT"TITLE NUMBERS (E,0,0,0)";N,Y
0034 FOR K=0000,01000:5000:10
0035 PRINT CHR$(147)
0036 :
0037 FOR J=1 TO 000
0038 SYS PLOT+1+0+10000+1000,1+000+1,0,0,0,0
0039 NEXT
0040 :
0041 REM SCREEN-CURF
0042 :
0043 OPEN "4,0" FOR WRITE:CLOSE:OPEN "4
0044 FOR I=0 TO 04:FOR J=0 TO 00
0045 B=PEEK(1000+1000+J)
0046 C=COL00000
0047 PRINT#4,AB+BC+Y
0048 NEXT J:PRINT#4,END
0049 :
0050 AB="1000" : BC=""
0051 IF A=00 THEN 0050
0052 AB=CHR$(00)+C+CHR$(140)+0+CHR$(A-04):RETURN
0053 IF A=00 THEN AB=CHR$(A):RETURN
0054 IF A=01 AND A=00 THEN AB=CHR$(A):RETURN
0055 IF A=02 AND A=00 THEN AB=CHR$(A+100):RETURN
0056 AB=CHR$(A)+04:RETURN

```

heading 'double density graphics' complete with diagrams and very full explanations of the manipulations involved.

Lines 1-1000 represent an implementation of medium-resolution graphics using BASIC only. This is fairly slow but is speeded up somewhat by making use of a machine code routine to make the colour RAM so that we are not concerned with two POKEs for every point plotted. The program is given by default for the C64 but the changes needed for the VICs are minimal immediately after each of the affected lines.

Lines 10-60 are concerned with constructing a small 'look up' table.

Lines 100-140 read in the machine code for subsequent changes of colour RAM.

The major routine is in lines 100-100 which computes a sine curve and then plots it (on the first of the J loops) and then 'unplots' it (on the second of the J loops).

The procedure for VIC centers is to delete the following lines: 110,120,130,140,150,160,170. Now take the lines that immediately follow these (i.e. 171,171,171,171,171,171,171,171) and remove the REM portion of the statement that made these lines inoperative in the C64 version. You will also have to decide which version of VIC expansion you are operating with, as the screen shifts from 01000 to 01000 just to make life confusing. Select either line 1001 or 1001.

Line 100 having been deleted makes the VIC version end in line 101.

Centers of the C64 now have a machine-code version of the above which plots a looped figure in the shape of a butterfly. An illustration of this is also given.

Lines 2000-2010 read the machine code into the cassette buffer. Then you are given a choice of background and pen colour (12 for background and 0 for pen colour i.e., black on light grey is my personal favorite).

PLOT is defined as 070 and this is the entry point.

Notice the complicated formula in line 400 which actually follows the output SYS PLOT+1+0+1000+1000,1+000+1,0,0,0,0. The first computed value is obviously the x value while the second computed value is the y value. For a 'plot' we would then have a 1 and for an 'unplot' or 'erase' we would have a 0. Finally, we have the colour intended for the plot. You can obviously experiment with it as much as you like.

The origin is in the bottom left-hand corner (SYS PLOT+0,0,0,0) while the opposite corner is 1000,1000,1000,1000.

Finally, lines 01000-01100 constitute a screen dump, written in BASIC but more than adequate.

Nick Hampshire reveals the mysteries of the TED chip in the C-16 and Plus/4.

TED CHIP

THE GRAPHICS DISPLAY, SOUND GENERATION and internal clock/timers of the C-16 and Plus/4 computers are controlled by a single integrated circuit, the so-called TED chip. This is a complex device, and, unfortunately, rather difficult to use.

An equally unfortunate circumstance is that no information on the use of this chip is provided in Commodore's manual. This is presumably in the belief that the graphics and sound commands supplied in the extended Basic are adequate. However, most advanced programmers,

especially those writing machine code programs, will want direct access to the registers of this device.

The TED chip is a rather strange device. It is located in the middle of the internal ROM area and overlays this ROM so that the ROM area controlled by TED is inaccessible. In addition, the TED registers are not grouped in one continuous area of memory. We located TED registers in the area \$1D00 to \$1F3F. The reason for this is obscure and probably related to a quirk in the chip's design.

In operation the TED chip is not unlike the VIC and SID chips in the C64 and it is worth studying one of the advanced books on the 64 (for instance *Advanced Commodore 64 Graphics and Sound* and *The Commodore 64 Kernel and Hardware Revealed* - both by Nick Hampshire).

The following table shows the locations in TED which we have uncovered together with the function of each register and the bits within each location.

TED Graphics/sound/keyboard control.

\$1D00	— Timer 1 low	5	1 = Voice 2 tone enable
\$1D01	— Timer 1 high	4	1 = Voice 1 enable
\$1D02	— Timer 2 low	3-8	Voice(s) (3-8 only)
\$1D03	— Timer 2 high	Bit 3	Bit map base
\$1D04	— Timer 3 low	2	1 = chars from ROM, 0 = chars from RAM
\$1D05	— Timer 3 high	1-8	Voice 1 high
\$1D06	— Video control 1	\$1D10	— Character base address
Bit 7	Not used	Address of UDSc (28 steps)	
6	1 = extended background	2	1 = lower case
5	1 = Bit map	\$1D14	— Screen base address
4	0 = blank screen	Address of colour memory	
3	1 = 25 lines, 0 = 24 lines	Bit 7-3	(28 steps, screen 15 above colour)
2-0	Vertical smooth scroll pos	\$1D16	— Background colour
\$1D07	— Video control 2	Not used	
Bit 7-4	Not used	Bit 7	Luminance (0-7)
6	1 = Multi-colour	6-4	Colour (0-15)
5	1 = 40 columns, 0 = 38 columns	3-0	— Extended back 1/4M cell 1
2-0	Horizontal smooth scroll pos	Bit 7	Not used
\$1D08	— Out 1: keyboard column or joystick (FD or FA)	6-4	Luminance (0-7)
	In: keyboard row or joystick switches	3-0	Colour (0-15)
\$1D09	— Interrupt control	\$1D17	— Extended back 2/4M cell 2
Bit 5	T3 has run out	Bit 7	Not used
4	T2 has run out	6-4	Luminance (0-7)
3	T1 has run out	3-0	Colour (0-15)
1	Raster compare occurred	\$1D18	— Extended back 3
\$1D0A	— Interrupt enable	Bit 7	Not used
Bit 5	1 = T3 enable	6-4	Luminance (0-7)
4	1 = T2 enable	3-0	Colour (0-15)
3	1 = T1 enable	\$1D19	— Border colour
1	1 = Raster enable	Bit 7	Not used
\$1D0B	— Raster compare low byte	6-4	Luminance (0-7)
\$1D0C	— Screen offset from base for cursor (high byte)	3-0	Colour (0-15)
\$1D0D	— Screen offset from base for cursor (low byte)	\$1D1C	— Bit 0: Raster position high bit
\$1D0E	— Voice 1 low byte	\$1D1D	— Raster position low byte
\$1D0F	— Voice 2 low byte	\$1D1E	— ROM in when written to
\$1D10	— Voice 1-8 voice 1 high	\$1D1F	— ROM out when written to
\$1D11	— Sound control	\$1D18	— Bit 2: raster switch sense (0=down)
Bit 7	Disable sound	\$1D19-1D1F	— res. 0p, 1p=0p down
6	1 = Pause on voice 2		

Scratchpad

**A fistful of DATAs — more of
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WELCOME TO THE PAGE FOR YOUR programming bits and pieces. We're interested in anything, useful or amusing, from a few POKEs to a short utility and we'll pay for anything we use, just send us your program (either as a listing or on cassette or disk) and some notes as to what it does and how it does it. Post your contributions to Scratchpad, Your Commodore, No 1 Golden Square, London W1R 3AB.

That 'T' Is Bleepin Keyboard

Andrew Weinand ticks off this month with a machine code utility that produces a beep every time a key is pressed. It might be a help for anyone who has a clicky keyboard or can't manage two finger typing but watch out — it does mean everyone else can hear what your typing speed is like!

Andrew's program takes over the C64's regular interrupt and uses voice 1 on the

MD chip to provide an expensive sounding beeper.

Clean Living

Wash is a handy disk utility supplied by Clifford Hanger of Atteringsmore in Dorset. It lets you slog through all the files on a disk one by one using the space bar. You can delete the current file by pressing X or rename it with R, even better, pressing V lets you take a peek at what's in the file so you can figure out what it is and then scratch it if you don't need it.

The VIEW command works with all files though it cuts out any control characters and replaces them with full stops. Even so, you should be able to get a good idea of what the file is. One problem — after viewing a file, Wash sometimes goes back to the title of the disk — just hit space a few times to go-onward again. It just goes to show — you can write a useful utility in Basic!

Oh No, Not Again...

Printing at a particular position on the screen is still the most talked about subject in C64 programming. Graham Bligh of Darleigh in Hampshire has pointed out that David Reed's routine in Your 64 issue 11 won't let you print on the top line of the screen because you've got

to POKE 214,0-1 and then PRINT. Oh yes — I wondered when someone would spot that!

Graham has a neat solution — call the routine in the normal ROM which recalculates the cursor position. The PRINT-AT routine then becomes:

```
POKE 214,POKE 214,Y/32% 5672
```

Meanwhile, Asmat Ullah from Glasgow has a reasonably clever machine code solution. It's only 12 bytes of code so it should be no trouble to include it in your initialisation section. Once loaded, you can point anywhere on the screen with:

```
SYSTEM$Y,"MESSAGE"
```

Now hah! Asmat does point out that there's no error checking in the routine in order to keep it short so you should make sure that X is less than or equal to 40 and Y is less than or equal to 25. Even so, it has to be the best yet. Unless, of course, you know better...

```
1 REM PRINT-AT ASMAT ULLAH
2 FOR Y=0 TO 25:READ Y:POKE
3 Y,NEXT
4 DATA 32,124,160,184,208,232,256,280
```

Clean Cut Characters

Fred Barnham of Darwen in Lancashire has sent in a delightful utility that replaces all those hard to read control codes in listings with clear mnemonics such as CLR, EOL, EOP and so on. Just enter POKE 5,15:CLR and run the listing below. You'll find LIST a changed command...

ANDREAS WEINAND LISTING

```
100 REM KEY BEEP BY ANDREAS WEINAND
110 REM START WITH SYS 832
120 FOR Y=0 TO 250
130 READ X:POKE 1,X:Y=Y+1:HEAT
140 GOSUB 20,141,174,172,160, 69,161,
15,170,168, 68
150 GOTO 241, 4,174,168, 68,162,157,161,
3,173,170, 0
160 GOTO 20,169,100,100,166, 3,161, 60, 3,
162, 21, 3, 99
170 GOTO 165,203,201, 64,208, 3, 78, 48,
209,162, 17,162
180 GOTO 4, 5,212,161, 67, 27,169,139,166,
3,163, 20, 3
190 GOTO 12, 21, 3,169, 12,161, 66, 27,
76, 19,234,165
200 GOTO 203,205, 67, 27,208, 12,174, 66,
27,202,240, 6
210 DATA 162, 66, 27, 76, 19,234,169, 0,
161, 4,174,168
220 DATA 100,166, 3,161, 20, 3,162, 21,
3, 76, 48,234
230 DATA 0
240 IF 0 THEN GOTO 1 THEN PRINT "ERROR IN DAT
A":GOTO
250 PRINT "OK"
```

CLIFFORD HANGER LISTING

```
10 REM DIRECTORY WASH: C HANGER 1986
20 PRINT "C:\PATH\101,\" wash$":PRINT
30 PRINT "... FOR CLEANER DIRECTIONS:"
40 REM READ DIR
50 OPEN B,15
60 OPEN L,B,0,"R"
70 GET#1,AB,BB
80 GET#1,AB,BB,AB,BB
90 C=0:IF AB="" THEN C=ASC(AB)
100 IF AB="" THEN C=ASC(BB)*256
110 CB=STR$(C):CB=LEFT$( " ",9-LEN(CB))
+C
120 SET#0,BB:IF 0 THEN PRINT:PRINT C
B," BLENDS FILE",CLOSE 1,GOTO 100
130 IF BB+CB<36 THEN THEN 120
140 FB=""
150 SET#0,AB:IF AB+CB<36 THEN FB+FB
+BB,GOTO 150
160 SET#0,AB:IF AB="" THEN 160
170 TB+AB
180 SET#0,AB:IF AB+CB="" THEN TB+TB+BB:GO
TO 160
190 IF C=0 THEN PRINT:PRINT "TITLE=" ,F
B:PRINT,GOTO 100
200 PRINT FB,TAB(18),"RELASH=",CB,DAB(27)
,"TYPE=",LEFT$(TB,3)
210 PRINT:PRINT "SEARCHING FOR NEXT FILE"
```



```

800 REMIT OF MESSAGE "
810 REM GET COMMAND
820 GET A$: IF A$="" THEN 830
830 PRINT A$:PRINT
840 IF A$="Q" OR A$="X" THEN CLOSE 1:PRINT
    "CLOSE 2:END
850 IF A$="H" THEN 860
870 IF A$="S" OR A$="A" THEN PRINTA$:GOTO
    1:FB
880 IF A$="R" OR A$="I" THEN 888888888888
890 IF A$="U" OR A$="V" THEN 888888888888
9000
910 IF B%-0 THEN 920
920 CLOSE 1:CLOSE 2:END
930 REM MESSAGE FILE
940 INPUT"NEW NAME " :A$
950 IF A$="" THEN PRINT:RETURN
960 PRINTA$:A$=" " :FB:PRINT:RETURN
970 REM VIEW FILE
980 PRINT:PRINT"VIEWING " :FB
990 PRINT:PRINT"MESSAGE TO PAUSE, WMM TO
    ABORT":PRINT
1000 OPEN A$,B$, "Q" :FB:" " :LEFT$(B$,12) :
    B$
1010 GETC,A$: IF B%-0 THEN 1030
1020 CLOSE 3:POKE 174,0
1030 PRINT:PRINT"FILE SHOW":PRINT:RETURN
    B$
1040 IF A$="" THEN A$=CHR$(ASC(A$)+10) AND 15
    7:IF A$=CHR$(10) THEN A$=" "
1050 PRINTA$:
1060 GETC,A$:IF B%-1 AND A$="" THEN 1060
1070 IF A$="" THEN A$=CHR$(174) :FB
1070 IF A$="H" AND A$=" " THEN 1000
1080 CLOSE 3:POKE 174,0

```

```

100 PRINT,PRINT"*****",PRINT,PRINT,PRINT,PRINT
110 RETURN

```

PAUL BARNHAM LISTING

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